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~~Majr Genl Sir H. Douglas~~
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OBSERVATIONS ~~on~~
ON

ON SYSTEMS OF FORTIFICATION,

INCLUDING THAT PROPOSED BY M. CARNOT,

AND A

COMPARISON OF THE POLYGONAL WITH THE BASTION SYSTEM;

TO WHICH ARE ADDED,

REMARKS ON INTRENCHED POSITIONS, AND A TRACT ON THE
COASTAL, LITTORAL, AND INTERNAL DEFENCE OF ENGLAND.

BY

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P R E F A C E.

ON the occasion of offering to the world a reprint of a work published more than forty years since, the author is desirous of explaining the reasons which have induced him to revert, at this distance of time, to a subject then justly thought to be of much importance; but which to many has appeared since to have lost its interest, and, for the object originally proposed in its publication, not to admit of being revised with any practical advantage.

One of the reasons, as the author hopes to show, is that the subject, far from having lost any of its interest, assumes now a degree of importance greater than ever. What was, nearly fifty years since, only a theory has now been reduced to practice: the principles of M. Carnot having been extensively adopted by Prussian and Austrian engineers, in re-modelling the fortresses of their countries, and in constructing new ones. The strength and security of these, are objects of the most vital importance to all those nations by whose exertions, in one common alliance, the great war arising out of the French Revolution, in 1793, was brought to a successful termination. Europe was delivered from a state of humiliating subjugation, and rendered capable of

repressing any aggressive attempts which might hereafter be made by France to extend her dominion beyond the limits to which she was then restricted. We are now, near the end of 1859, arrived at a most eventful period. Throughout the whole of Europe the minds of men are in a most unsettled state as to the question of peace or war. Commercial rivalry, the ambition of dominion, and a desire on the part of the great Continental powers to provide, respectively, for their national security, have induced those powers to put their fleets and armies on a full war establishment, even during a time of peace, as if in anticipation of a coming storm. No one can pretend to divine in what quarter it may arise; yet everyone feels that the state of Europe, with respect to the question of peace or war, depends upon the will of an absolute monarch. The present Emperor of the French was raised to his high station by the suffrages of the people and the army of France; apparently in the expectation that, by treading in the footsteps of his great predecessor, he would restore the military glories of France, retrieve and avenge the disasters of the war which terminated in 1815, and make to recoil on the powers of Europe the consequences resulting from the parts they had taken in the overthrow of the first empire: and, in this, Napoleon III. has in a great measure succeeded. It remains to be seen whether the French people will be satisfied with what has been done: whether the Imperial Army will be contented with the laurels it has so

gallantly won, and whether the ambition of the sovereign will be fully gratified by the renown he has gained in the battles he has fought and the victories he has achieved ;—whether he will resist the temptation to pursue a career of conquest, and devote himself to the improvement of his dominions and to the maintenance of peace in Europe.

The author cannot forbear giving, in this place, the substance of a passage in an eloquent speech delivered by Lord Brougham, a few days since (Oct. 26, 1859), at Edinburgh. His Lordship described the arch-tempter as holding out to France the laurel—the emblem of glory ; and to this country, the apple—the emblem of wealth and prosperity. By the one, our neighbours are incited to war and conquest ; and by the other we are likely to be lulled into a false security, and induced to neglect the means of defence while danger is imminent. It is sincerely to be hoped that the noble and learned orator's confidence that we shall be found completely prepared, both by sea and land, for any attack that may be made on us, will be strictly verified.

The possibility that the passion for military glory may predominate in the councils of the French nation is the real source from which our danger springs. Should any circumstances unfortunately arise to interrupt the harmony at present happily subsisting between the Governments of France and Great Britain, we may suddenly find ourselves involved in a war in which

our existence as a nation may be menaced. The institutions under which the people of the two nations live and are governed are of entirely opposite characters and these necessarily produce contrarieties in habits of thought, by which discordancies in sentiment, sufficient to lead to open hostility, continually arise.

Against such contingencies England is bound to be prepared: of her ability to defend herself no doubt can be entertained—the difficulty lies in organizing the military resources of the country consistently with the spirit of her free institutions.

The principles of fortification have undergone such great changes since the work was first published in 1824, that, in preparing a new edition, the author felt it incumbent on him to extend his observations from the system which was the immediate subject of the work, to those which may be considered as having, in a great measure, sprung out of it, and which participate more or less in its defects. The recent improvements in the service of artillery, by which the ranges of the weapons used in the attack and defence of fortifications have been so vastly increased, have caused a radical change in the system of fortifying towns by forming about the base of the walls a line of rampart almost immediately behind the dwellings which they were intended to protect. The system of an elaborate system of outwork has been almost entirely abandoned; and a system of defence has been adopted which is adapted to the contour of the place, a

such a distance from thence as to put its centre beyond the range of artillery of the highest calibre, to be substituted. On this account, the author has thought himself justified in devoting a portion of the work to a development of the principles on which towns should be put in a state of defence, and those on which sites should be selected as most fitting, when properly fortified, to constitute intrenched camps, or strong military positions. He has endeavoured to illustrate the subject by references to the best works of the kind which have hitherto been executed.

The measures which may be adopted by the Government for the defence of the country, in existing circumstances, the author has endeavoured to point out in the Tract which terminates the work now submitted to the consideration of the public. England will never be the aggressor, but, should the demon of war be unchained, she must be found well prepared for the contest; and all orders of men in the nation must fulfil the duty which will be imposed on them, of maintaining in perfect security the independence and integrity of the British Empire.

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OBSERVATIONS
ON
NEW SYSTEMS OF FORTIFICATION,
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PART I.
ON CARNOT'S SYSTEM.

CHAPTER I.

OBSERVATIONS ON THE ERRONEOUS PRINCIPLES IN M. CARNOT'S
THEORY OF DEFENCE BY VERTICAL FIRE.

1. WHEN France had succeeded in establishing almost universal dominion over the continent of Europe, M. Carnot promulgated his 'Treatise on the Defence of Fortified Places,' in obedience, as he informs us, to the command of Bonaparte, "in order to show to the military men entrusted with the defence of the bulwarks of the state, the importance of their functions, and the extent of their obligations—the glory which attends the faithful discharge of their duties, and the misfortunes which those, who either neglect or betray them, must draw upon themselves and upon their country."

2. This appeal was particularly addressed to the troops occupying the fortresses which the French retained in a foreign territory, and to the garrisons of their frontier and interior places, at the time Napoleon the First began to prepare his mighty means for the Russian war. To stimulate to the utmost the defensive energies

" Pour rappeler aux militaires chargés de la défense des boulevards de l'état, l'importance de leurs fonctions et l'étendue de leurs devoirs ; la gloire qui les attend lorsqu'ils ont su les remplir, et les malheurs qu'ils attirent sur leur patrie et sur eux-mêmes lorsqu'ils les ignorent ou les trahissent."

of those garrisons, the work contains succinct and very partial accounts of memorable sieges, together with a code of imperial laws detailing the circumstances and evidences of extremity, under which, only, governors or commandants of fortresses would be justified in capitulating, without incurring the severe and summary penalties denounced against those who should surrender their posts without full compliance with the terms of these decrees.

3. The sanction of Carnot's celebrated name introduced his work into very general circulation: it was translated into our language, and the imposing reputation of the author as a mathematician and an engineer powerfully patronised his new theory:—That a Fortified Place may be rendered impregnable by a general use of *Vertical Fire*, meaning a discharge of shot from guns or small arms at considerable angles of elevation.

4. M. Carnot tells us that he had long been convinced of the vast advantages which would result from adopting vertical fire as the basis of defence, instead of using it as an accessory; but that he did not make his theory known, lest the discovery should be practised against the offensive operations of his countrymen. "But now," he observes, "that our enemies have few places left to defend, I no longer hesitate to render my ideas public, since any improvement in the defensive art must turn, almost exclusively, to the advantage of the French frontiers."

5. Before Napoleon entered on the remote enterprise which his insatiable ambition impelled him to undertake, it became especially necessary to adopt every possible precaution to ensure the constancy of his allies, to maintain the internal tranquillity of his empire, to stimulate elsewhere a defensive system, during the absence of the grand army; and to urge to the last extremity the defence of his frontier places, in the event of any failure in his external operations. These great objects, he rightly considered, would all be best promoted by giving to public opinion, from high professional authority, such impressions of the security in which these strongholds were left, and of the impossibility of reducing them, as might deter any attempt at

defection or conspiracy, and give enthusiastic confidence in the means of resistance. To effect this, it was necessary to assert the discovery of some fallacy in the idea of a balance which, since the days of Vauban, has been supposed to exist, with calculable certainty, in favour of attack; but as such a revolution in public opinion could not be established by any new arrangement of known or ordinary means, M. Carnot boldly and ingeniously proclaimed the discovery of a new mode of defence, by which fortresses might be rendered absolutely impregnable, and by means so simple as to be easily adapted to all places. In promulgating this new doctrine, Carnot introduced some useful materials and observations calculated to excite protracted defence; but his general reasoning is quite delusive. He wrote as a political engineer, or rather he compiled the treatise which, he informs us, Napoleon sketched; and the deduction drawn from it is, perhaps, one of the most curious and interesting passages that ever emanated from the imperial press.* "From what we have just read," says the author, "results, I think, very evidently, this tranquillizing truth, that the barriers of the French empire are absolutely inexpugnable by any power, or coalition of powers, whatever, if well defended." What a subject for reflection, and exultation, does this extraordinary paragraph present! In it we discover the ground upon which Bonaparte founded the delusive conviction, that his empire was secure against any "*réunion de puissances*," whatever might be the issue of his exterior operations. This presumptuous declaration, circulated afresh about the time he was forming the plan of his final aggression, vainly assumes the perfect stability of the fulcrum upon which he expected to complete the subjugation of Europe, and shows that the operation in which it was thought that he risked much, and which proved so desperate, was considered by him,

* "De l'écrit," says the writer, "qu'on vient de lire, résulte, je crois, bien évidemment, cette vérité tranquillisante, c'est que les barrières de l'empire Français sont absolument inexpugnables, pour quelque puissance ou réunion de puissances, que ce soit, si elles sont bien défendues."—Page 438, 4to. édition; page 476, 8vo. ed.

and declared by the ex-minister of war, one in which there was full security from that reaction which we have seen recoil upon it with overwhelming force. It is most interesting, therefore, to reflect, that the confidence inspired by the "*vérité tranquillisante*" asserted in this little paragraph, was, beyond all doubt, the exciting principle, the stake and basis of his operation, and the delusion which contributed to his overthrow; for the Russian war was undertaken upon a deliberate calculation, that his empire was inexpugnable by the very "*réunion de puissances*" which destroyed his tyranny and delivered Europe.

6. But, leaving these reflections to the political reasoner, it appears to the author to be a professional object of some importance, to endeavour to expose the doctrine which M. Carnot promulgated for a political purpose—correct the professional tendency of his work—and try to restore the confidence, which it has shaken, of success in attack, if conducted properly with sufficient means, against places strong only from art. For as our fortresses are either impregnable from advantages of site, or protected by our naval superiority, and our operations in war are such that we are more frequently the assailants than the defenders, it follows, that the moral effect of this work operates against Great Britain; and, consequently, that it is our policy to expose and correct that doctrine which tends to invigorate and protract defence by delusive assurances of superiority, and to deter enterprise by weakening confidence of success—for such are the tendencies of the work on all its readers; and, perhaps, no military treatise ever had more.

7. The object of Carnot's work, with every other military speculation, naturally lost much of its interest when the troubles of Europe subsided into peace; but a crisis having now arisen* which may afford Bonaparte occasions for practising his favourite scheme, or which may derive security from the delusion which that scheme may create, it cannot but be important to consider the project in its details.

* This part was written immediately after Bonaparte's escape from Elba.

8. M. Carnot tells us, that the uses and vast advantages of vertical fire not having been analyzed, we are not aware of the prodigious effects it is capable of producing; and he proceeds to exhibit his estimation of its powers in an enthusiastic description, which has carried with him a large portion of his readers. Few have ventured to doubt its efficacy, and no one has publicly noticed a very material defect in his theory, which in a great degree vitiates the formidable effect he ascribes to vertical fire with small balls.

The work is so well known, that the author need not take up much time in bringing before his readers those parts of it to which his observations will first be directed.

9. M. Carnot recommends, that the besieged should begin to make use of vertical fire upon the commencement of the construction of the third parallel, and from that period of the siege keep up an incessant discharge of musketry and 4-oz. iron balls, at great elevation, upon the enemy's works, so as to form a rain (*pluie*) of shot upon the trenches. The iron balls to be discharged from a number of 12-inch mortars, two of which are placed in the salients of each bastion and ravelin in the front or fronts attacked: each mortar throwing 600 balls at every discharge.

10. M. Carnot introduces his theory of the effect of these balls by observing, that, of any number which fall in the trenches, the number that take effect will depend upon the proportion which the unoccupied part of the trench bears to the part which is covered by the men posted and working in it. Thus, supposing a man standing upon a horizontal plane to cover a space of about a foot square, and a man in the attitude of working somewhat more, M. Carnot calculates that the projections of the bodies of the men usually working and posted in the trenches will occupy about $\frac{1}{180}$ part of their surface; from which he infers, that of every 180 balls that fall in the trench, one should, according to the doctrine of chances, hit a man; and he does not doubt that it will put him "*hors de combat*."

11. There is some obscurity as to the elevation at which M. Carnot proposes to commence this vertical fire, and in the modifications either of charge or elevation which must be observed, to fire upon the advancing saps. The distance at which he proposes to open vertical fire is about 140 yards from the body of the place, and only about 70 from the covered-way. To project a musket ball, or a 4-oz. ball, to this short range, with an elevation of 45° , the charge must be so small that the projectiles would do little more execution than if thrown by hand; and, if the elevation be constant, the charges must be further diminished, to procure shorter ranges in proportion as the saps are pushed forward. This would render M. Carnot's vertical fire more impotent in proportion as the attack advances; and the continual reductions of charge would be extremely complicated and uncertain, whilst the whole practice would be at variance with his expression "*pluie de balles*." It is, apparently, his meaning, that the charges should be constant, and the elevation varied. "It is necessary," he says, "to make previous trials, in order to regulate the range, and vary at pleasure the angle of elevation." This clears the obscurity of the general enunciation of his project, and shows, that the elevation, which at the commencement of his vertical fire cannot be less than 45° , must be further increased as the saps are pushed forward, so as at length to become almost strictly vertical, when the shot is directed upon the lodgments on the crest of the glacis.

12. M. Carnot's idea, then, of the effect of this "*pluie de balles*," is founded upon the velocities which he supposes they will acquire in their accelerated descent from the vertex of a very elevated trajectory. This is manifestly the principle upon which he tries to establish his theory; and this it is which, disregarding for the present the doctrine of chances, the author has first to remark upon.

13. Had M. Carnot founded his system upon a power evidently as impotent as the projectile force of a boy's

arm, this part of his work would not have merited serious investigation; but the principle he assumes is specious, and the impression it has produced so considerable, that the author has been induced to draw up the results of a careful investigation by which he has satisfied himself, and hopes to satisfy his readers, that 4-oz. iron balls, or cubical pieces of iron of one inch (Fr.) side, cannot, in descending from the vertex of a very elevated curve, acquire velocity sufficient to give a mortal blow, excepting on an uncovered head; and that the effect of musketry under such circumstances would be almost harmless.

14. It appears that M. Carnot has formed his theory upon the hypothesis of the shot falling in a non-resisting medium, which the author must inform such readers as are not acquainted with these matters, is erroneous in all cases—is particularly and greatly so with small projectiles; and its deductions, as applied to the velocity of descent of small balls fired at great elevations and short ranges, are quite fallacious. The velocity of the ball in a horizontal direction (which by this theory would be constant, and which is, to the projectile velocity, as radius to the cosine of the angle of elevation) being inconsiderable, when the elevation is great, it is evident that the effect of vertical fire must depend upon the velocity of descent in the direction of the curve. Estimating this, according to the parabolic theory (as proportioned to the secant of the angle of elevation), the motion would be slowest at the vertex of the curve, and the velocities of the projectile would be equal at equal distances from that point. According to this supposition, we may assign to the descent of small balls, discharged at an elevation of 75° or 80° , such accelerated velocities as would, if true, be quite sufficient to do good service in the way M. Carnot suggests; but the fact is, that on account of the resistance of the air, there can be no acceleration beyond a limit which, with small balls, is very much less than is generally imagined.

15. From the vertex of the curve, where all the

velocity (g , the force of gravity, being 32.16 feet, and k , from the best experiments, equal to .25), the terminal velocity of such musket bullet is found to be 170 feet per second, nearly. The potential altitude, or the height from which the bullet must descend *in vacuo* to acquire a velocity nearly terminal, will, from the formula in the work just quoted (Art. 76, Note), be 448 feet. It would, therefore, be a waste of means to use the full charge: for a musket ball fired upwards in the atmosphere, with the ordinary quantity of powder, would be projected to the height of 970 feet; and it is evident that a height greater than 448 feet is quite unnecessary.

The indentation which a musket ball, moving with a velocity of 170 or 180 feet per second, makes on a piece of elm timber, is about $\frac{1}{10}$ of an inch: this might, perhaps, be sufficient to knock a man down, if by great chance it were to fall on his head; but in no other case would it put him *hors de combat*.

With respect to the 4-oz. balls; the diameter of the French 4-oz. ball is 1 inch, $2\frac{1}{2}$ lines (Fr.), which, in English measures, is 1.28038 inches, and its radius is, consequently, equal to .05335 foot ($=r$). The specific gravity of air is 1.2, while that of cast iron is 7207, and of wrought iron, 7788; therefore, in the above formula for the terminal velocity, $\frac{g}{8} = 6006$ for cast iron, and 6490 for wrought iron: hence, the terminal velocity of a cast iron ball of 4 oz., is 203 feet, and of a wrought iron ball of equal weight, is 211 feet. The height due to the terminal velocity is, in the first case, 641 feet, and in the other case, 692 feet.^a

^a Were it not for the resistance of the atmosphere, which limits the acceleration of a falling body, the vertical velocity of rain would, near the earth, be so great as to beat down all tender vegetation; and hailstones, even of moderate size (hailstones of two or three ounces' weight are not uncommon), would, when driven by violent storms of wind, or in their fall, do most serious mischief. History has recorded some remarkable facts attending the descent of extraordinary hailstones. In the year 459, hailstones more than three inches in diameter, which fell in many parts of Britain, killed many men and much cattle. In 1359, the hailstones which fell near Chartres, killed 6000 horses and 1000 men of the troops under Edward III.; and in 1510, a hail-storm in Italy destroyed all the fish, birds, and beasts where the stones

18. M. Carnot recommends that the balls should be made of hammered iron; but adds that, as the charge of powder for a mortar is small, balls of cast iron may resist the explosion without breaking, and will answer as well. Now this observation shows that the author had not considered the effect of the air's resistance, nor doubted a sufficiency of force in his vertical fire: for the weight of a ball of hammered iron is greater than that of a ball of cast iron of equal diameter, and the superior weight or urging force of the former would generate greater terminal velocity than a lighter ball of the same size could acquire; the momenta of the two balls in question would be as 19 to 18.

19. Four-ounce balls, discharged at elevations even considerably above 45° , to the distance of 120 yards, would not inflict a mortal wound, excepting upon an uncovered head. They would not have force sufficient to break any principal bone; there would be no penetration, but merely a contusion.* This certainly would

fell. Again in 1697, hail, which fell in Cheshire and Lancashire, killed many fowls and other small animals; it also knocked down several horses and men—some of the stones weighed half a pound; and at Antwerp, in 1776, a fall of hailstones, weighing three-quarters of a pound, killed several horses. We have witnessed a beautiful practical exhibition of the doctrine of terminal velocity in the descent of the parachute, in which the hardy aeronaut, detaching himself from his balloon, falls with accelerated speed until the resistance of the air to the expanded canopy becomes equal to the total weight of the descending body, after which it falls to the earth with uniform velocity nearly. To the man of science these illustrations may appear superfluous, and perhaps obtrusive; but the author knows from experience, that such familiar illustrations are necessary to convey his meaning to those who, like the theorists of no remote period, make no allowance for the resistance of the air, which is now known to be such that a 24-lb. ball, moving with a velocity of 2000 feet in a second, would suffer a resistance of 800 lb. nearly.

* The following experiments amply confirm this assertion. With respect to terminal velocity it must be remarked, that although balls may not be thrown to a height sufficient to produce a velocity nearly terminal, yet the resistance of the air prevents, from the first, a uniformly accelerated descent. Thus the effect of the balls discharged at 75° elevation, was far inferior to that which we should assign to them according to the parabolic hypothesis.

A coëhorn mortar was placed 100 yards from six new deal targets laid on the ground, and two new wadmill tilts spread out near them, to estimate by the impression made on them the force with which the balls would fall.

The first round was with the usual tin case, containing 33 four-ounce balls, with a charge of one ounce of powder, elevation 45° . The case went bodily about 130 yards without breaking.

Loose balls were then put in over a wooden bottom. After a number of

not oblige the besiegers to cover themselves with *blindages*, as M. Carnot imagines; for a strong cap or hat, and a cover of thick leather for the back and shoulders, would be sufficient protection from the effects of his vertical fire with small balls.

20. As the quantity of balls required to feed mortars discharging 600 balls at a time would be very considerable, M. Carnot observes that cubes of iron of 8 or 10 lines side, cut from square bars of this dimension, may be substituted. These, he says, may be fired from mortars, howitzers, or stone-mortars, and will produce the same effect as balls (page 491, Carnot).

Let us consider this:—

10 lines French are equal to ..	:89523 inch English.
The content of the cube is ..	·71746, and
Its weight is	3·0822 ounces.

Now take a cast iron ball of the same weight:—

Its diameter is	1·111 inches.
Its terminal velocity is ..	190 feet per second, and
Its potential altitude is ..	556 feet.

We have no experiments from which we can ascertain the terminal velocity of square shot; but from comparative experiments with round and flat surfaces, we know that the resistance of the air to the flat end of a cylinder is more than double the resistance to a ball of the same diameter. Thus, although the urging

rounds with the above charge and elevation, with different numbers of four-ounce balls, it was ascertained that the coëhorn would throw 42 of them 100 yards, and that the spread was, on an average, about 10 or 12 yards. It was not very easy to hit the targets and cloths, although they covered a surface of 774 square feet; but, in one instance, 22 balls left their marks. The indentation on the surface of the deal was so small that it could not well be measured—it certainly was not more than $\frac{1}{30}$ of an inch deep. A ball thrown with force from the hand appeared to make an equal impression. Those which struck the wadmill tilt did not penetrate, but merely indented the ground underneath. The penetration of the balls into the ground (which was of the softest nature of meadow) was, on an average, two inches; but the balls thrown by hand did not penetrate so far.

The mortar was then elevated to 75° , and with two ounces of powder and 42 balls made nearly the same range as before; but the spread was increased to about 40 yards, so that it was difficult to hit the surface aimed at. Several balls did, however, at length fall on the targets and wadmill tilts. The impression on the former was something increased, but still so trifling as hardly to be measured; the balls did not go through the cloth, and the penetration on the meadow was only increased to about three inches.

force of a ball and cube of the same weight be the same, yet the surfaces upon which the resistance acts, (and very irregularly in regard to the cube), are very different:—

The surface of the ball is 3·87045 square inches.

The volume is 4·80862 cubic inches.

From these, together with what has been said respecting the descent of *balls*, we know, and that is enough for our present purpose, that the terminal velocity of the cube must be much less than 185 feet per second; and consequently its momentum inferior to that of a 3·08 ounce ball. The motion of a cubical shot will, besides, be quite irregular, descending sometimes with an angle, then a face, then an edge foremost, tumbling over and over in oblique, irregular directions, without any certainty, excepting that the velocity and effect will be much less than those of a round shot of equal weight.

21. I do not know^a that it would be prudent to call on M. Carnot, as a man of science, to defend his speculations; or that it would be right, at present, to publish an investigation which might lead him either to abandon his plan, or improve it by using heavier balls; and which would, at all events, show him that the part of it which depends upon the vertical fire of musketry would be positively impotent. If we have discovered that he has overlooked the circumstance which renders it so, we should not, until the war is brought to a close, show him the defects of a measure which, he informs us (p. 317), he is determined to apply if he should be charged with the defence of a fortified place; but keeping the conviction of his errors to ourselves, let us profit by the knowledge, if the system should be practised against us.

22. The observations in the preceding part of the text were written, in 1815, a short time previous to the ever-memorable campaign which terminated the war, and were circulated among a few professional

^a Written in 1815.

friends. The computations (lately revised) and the amount of experimental results have been added since.

In that investigation of the *principles* and effects of M. Carnot's vertical fire with small balls, the author has shown that he, M. Carnot, has fallen into great errors in principle, and that the practical deductions from his theory are equally erroneous. That engineer having pursued the subject in a subsequent edition, the author feels it incumbent upon him to follow up the remarks which he has made upon what we may consider the enunciation of his plan, with some observations upon the details of its application which he afterwards gave to the world.

23. In taking up the subject afresh, M. Carnot observes, that as artillery placed in battery upon the ramparts of a besieged town must necessarily soon be reduced to silence, and the effect of musketry from defenders who are exposed without cover to the shot and shells of the besiegers, is inconsiderable; there is no other way of continuing an efficient fire upon the enemy's trenches than to pour upon them a prodigious quantity of "*feux verticaux*"—that direct fire only hinders the enemy from advancing *à découvert*, without reaching him behind the cover he is enabled to throw up, whilst vertical fire falls upon him in his trenches, and admits of the ordnance, &c., by which it is discharged, being covered from the destructive effects of the besiegers' ricochets.

24. The author is by no means inclined to dispute the utility of vertical fire. He allows, to the full, its advantages as a powerful accessory in the defence of places; but he doubts the propriety of adopting it as the basis of defence, and contends that, if, in principle, a general application of it were expedient, the new nature of vertical fire proposed by M. Carnot is by no means so formidable, either in regard to accuracy or power, as to be considered an efficient feature of such a system of defence.

25. We cannot permit M. Carnot to connect his speculative notions, as an inventor, with the acknow-

fell was about 270 feet, allowing for the air's resistance in ascent. The height, 120 feet, which M. Carnot so vauntingly states, is, in a range of 100 yards, due to an elevation of 68° ; and he cannot now pretend, since it appears that an elevation of 75° only produced an indentation little more than $\frac{1}{20}$ of an inch deep in a deal plank, that the force of the same balls, discharged at 68° elevation to the same distance, would put a man *hors de combat*. As to his observation about the power of using heavier projectiles, from stone-mortars 15 inches in diameter, that is nothing new—it belongs not to him; and we transfer the consideration of it to the 3rd head, under which we propose to consider the long-established application of vertical fire, and to make some remarks on the uncertainty in the ranges of stones from mortars; and we shall notice, under the 2nd head, the allusion M. Carnot makes in this paragraph to the weapons of the ancients, and the support he draws from M. Folard's well known prejudices in favour of their means of defence.

28. It is quite clear, therefore, that M. Carnot's vertical fire with small balls would neither oblige the besiegers to use *blindages*, nor to act according to the principle which he makes for his own case, viz. to keep "*hors de portée*," which, in other words, as we find by the concluding part of the paragraph to which we allude,^a would be not to attempt to take the place at all. A leathern cover for the head and body would be as effectual against 4-oz. balls discharged in this way, as the tortoise of old was against arrows; and we might adopt, with great advantage against M. Carnot's vertical fire, such mantelets of green hides as were used by the ancients at sieges, to protect them from the missiles of the besieged.

^a P. 329. "Que les assiégés évitèrent la chute de ces projectiles, en se tenant hors de leur portée. C'est-à-dire donc, qu'on renoncerait à la doctrine actuelle des attaques, à cette doctrine par laquelle M. de Vauban leur acquit cette supériorité, qui s'est soutenue entière jusqu'à ce jour; c'est-à-dire, qu'il n'y aurait plus ni troisième parallèle, ni cavaliers de tranchée, ni couronnement de chemin couvert, ni batterie de brèche, ni par conséquent de places prises; à moins qu'il n'y ait un nouveau secret pour prendre les places sans en approcher."

jectile, of whatever diameter, would penetrate in the same proportion, with the same velocity of descent, in soil of similar nature: consequently an iron ball of about an inch diameter, fired under an angle of 45° to the distance of 70 toises, would penetrate rather more than an inch into soil of such consistency as the Champ de Mars. From this we may judge whether the objection which has been made be just, *viz.*, that these balls would not have force to put *hors de combat* the men who might be struck by them." Now this very observation proves, what we have already asserted, that M. Carnot had not sufficiently considered the effects of the resistance of the air. He is right in his theory that balls of different sizes, striking the earth with equal velocity, will penetrate in the ratio of their diameters; but different balls discharged with equal velocities will not *descend* with the same celerities. If a charge of 4-oz. balls, and a single shot weighing as much as the whole, be projected with equal velocity, the former will fall with much less velocity than the latter, and their penetration will be less, in the proportion of the squares of the celerities. The author need not engage in any further remarks on the fallacy of this theory. He has exposed its errors in principle, and established them by actual experiment.

31. It may be said, however, that these objections to M. Carnot's vertical fire may be done away or weakened by increasing the weight of the balls. This is true in the abstract, and it leads us to consider, 2ndly:—The principle of adopting any sort of vertical fire as the basis of defence, instead of using it as an accessory mean.

The distribution which M. Carnot proposes to make of his mortars and pierriers for vertical fire, on a front of fortification, is as follows:—

Three mortars in the salient angle of each bastion and demi-lune.

Three to fire *d'écharpe* on each of the four branches of the covered way.

The mortars or pierriers are placed behind the ram-

parts in small bomb-proof casemates, each large enough to contain a mortar and two or three men. The casemates, or as M. Carnot calls them, "*petites cases blindées à l'épreuve*," for the defence of the capitals, are placed perpendicularly to the capitals of the bastions or demi-lunes; and those to defend the four branches of the covered way are placed parallel to the works behind which they are erected, forming a sort of interior enclosure at the foot of the interior slope of the rampart. A large port or embrasure is left in the end of each casemate, to admit of the discharge of the mortar.

32. By this disposition the terre-plein of the rampart is left free for the reception of the ordinary artillery and musketry, which, however, he says, should not be used simultaneously with the "*batteries-blindées*," but, according to circumstances, in alternation with them. The artillery in the salients is mounted *en barbette*, protected by merlons of sand-bags, until the ricochet batteries of attack are established; after which the ordnance of the place is to be withdrawn from the ramparts* until the fire of the ricochet batteries is masked by the advanced-works of the attack. Thus, as soon as the enemy's ricochet batteries gain ascendancy over the artillery of the place, M. Carnot withdraws his ordnance and troops, and brings into action his "*batteries-blindées*," two-thirds of which are, at this stage of the siege, furnished with guns or howitzers to fire *à ricochet*, and the other third is armed with mortars. This arrangement of ordnance in the casemates is to continue until the third parallel be finished, when the guns and howitzers in the "*batteries-blindées*" are to be replaced by pierriers, which, together with the mortars, are then to discharge small iron balls, pieces of iron, case-shot, shells, and stones, on the enemy's approaches.

33. Having thus stated the general arrangements and principles proposed by M. Carnot for vertical fire,

* "D'abord dans ce nouveau mode, du moment que l'assiégeant a établi ses batteries au milieu de la campagne, il ne doit plus paroître sur les remparts, ni un seul homme, ni une seule pièce de canon."—*Discours Préliminaire*, p. 25.

it will be proper to consider first, the effect of this project upon the early stages of the siege, and then proceed to investigate that part of the operation which he considers to be only the commencement of the siege, viz., the construction of the third parallel.

The ricochet batteries being established for the purpose of dismounting the artillery on the faces, and of enfilading the troops in the covered way, of covering the progress of the zigzags and the construction of the second and third parallels, it is evident that to withdraw the ordnance from the ramparts, and most of the troops from the covered way, would be to abandon, almost without a struggle, the main object for which the fortifications are constructed; and the influence which such a measure would produce upon the early part of the siege would just be the same as if, at the first discharge from the ricochet batteries, all the guns on the ramparts were silenced, and most of the troops forced to withdraw from the works. The attack would consequently proceed with great rapidity; and, excepting by sorties, would be very little opposed until the commencement of the third parallel, or at least of the demi-parallels in their rear. Before this stage of the siege, sorties should not be attempted unless the besiegers commit some gross error in the general combination of their approaches or trenches, or push forward a part of their attack without proper support; or unless the nature of the ground conceal the advance of the sortie, and favour its retreat.^a For whatever be the effect of a sortie upon

^a Vauban says, vol. ii. p. 64 :—" Il me paroît que l'on est dans une grande erreur à l'égard des sorties et de la défense du chemin couvert. Je n'ai point vu que les sorties aient jamais fait grand effet contre des attaques bien conduites. Si on sort de loin, on s'éloigne de ses avantages pour entrer dans ceux de l'ennemi, qui vous ramène toujours battant jusqu'à votre chemin couvert, et vous tue, pour l'ordinaire, quantité de monde. Si l'on sort de proche, on fait encore moins d'effet, parceque l'ennemi étant prêt se rassemble bientôt, et ne manque jamais de vous ramener avec perte. Or il n'est que trop certain qu'un homme perdu de la part des assiégés, égale ou surpasse la perte de six ou sept de celle des assiégeans. Ceci ne veut pas absolument dire qu'il ne faille point faire des sorties, mais qu'il n'en faut pas tant faire, et les exécuter avec beaucoup de sagesse et de circonspection, et toujours par surprise, prenant bien son tems pour tomber brusquement sur l'ennemi, et ayant soin de s'assurer d'une bonne retraite."

the besiegers, it is always attended with severe loss to the troops composing it, particularly upon their retreat towards the place; and if undertaken at an early period of the siege, they are not sufficiently supported by the fire of the place, and generally return in a disorder hurtful to the spirit of the garrison. M. Vauban condemns any sortie being made beyond the distance of 100 or 120 toises from the place, and says^a that, "excepting under such circumstances as those just mentioned, or unless it can be done by surprise, the success of a sortie is very doubtful;" and he adds an observation, to which his vast experience in sieges gives great weight,—“I have seen a great many sieges, but I have never known sorties retard, by one half-day, the progress of well directed attacks.”

34. M. Carnot dwells much upon the importance of ricochet in defence, which, he says, is not sufficiently practised, and recommends a more general application of it from behind the ramparts, and from the dry ditches of the place: but it is evident that the only ricochet fire that can, with any advantage, be used from the place is upon the zig-zags crossing the capitals of the front or fronts attacked; and this application of it is clearly enforced by all the great masters of the art, whilst they urge at the same time the necessity of cannonading *direct* the heads of the trenches and saps, and the parallels.^b

M. Carnot, on the contrary, proposes ricochet fire *exclusively* at this period of the siege; but it is manifest

^a Page 115, vol. ii.

^b Cormontaigne says, vol. iii. p. 177 :—“On doit tirer de plus grosses pièces à plein fouet sur tous les endroits foibles de la tranchée, tant que l'on y verra des travailleurs.”

“Les coups de plein fouet sont utiles contre les réparations de la tranchée; les travailleurs sont ramassés dans ces endroits: et s'il y a des pierres dans les parapets, les boulets font beaucoup de mal à ceux qui sont derrière. Il est donc bien plus utile de ne tirer qu'à ricochet dans le courant du jour, comme la nuit, avec les précautions convenables, et seulement sur les zig-zags qui sont aisés à enfler et à plonger.”

Bousmard, p. 196 :—“Au jour, feu ordinaire de canon de plein fouet, sur les batteries de l'assiégeant, et à ricochet sur ses boyaux. Tous les mortiers tirent à ses batteries.”

that firing, *à ricochet*, perpendicularly across a parallel, will not oblige the besiegers to observe much circumspection; and that it is only against the repeated crossings of the zig-zags, to which the fire is also oblique, that any considerable effect can be gained.

35. M. Carnot, in his observations on ricochet, takes up a particular recommendation of Cormontaigne's, and makes a general application of it to the new project. The observation states, "Although ricochet fire has hitherto been used only in attacking places, there is no doubt that this practice is still more useful in defending them. The enemy's troops are every night exposed, without shelter, in constructing their works and covering their parties. Now, a bullet which grazes five or six times will be much more likely to do execution than a direct shot, which may either strike short of the mark, and in the next bound pass far beyond the trenches, or go over without touching at all."^a There is no doubt that ricochet fire is of great use in defence as well as in attack; and M. Cormontaigne, as well as all other masters and good practitioners of the art, adopt it accordingly: but, as shown in the passage just quoted from Cormontaigne, they only use it upon the capitals to ricochet the zig-zags, and not against the parallels, which, on the contrary, they cannonade by a direct fire. Much execution is always done in this way until the parallel is finished; and, even when completed, a direct shot, hitting near the crest of the parapet, will generally penetrate and do much execution. It is entirely from the effect of direct fire that the besiegers are forced to resort to the expedient of the sap, and they sustain great loss in carrying it on by day; but, if not opposed in this way, they might advance by day and night with very little circumspection, and consequently with great rapidity. Such a system of forbearance as M. Carnot proposes, would adjourn the commencement of a vigorous defence to what we must consider a very advanced stage of the siege; although he calls it but just beginning when

^a Cormontaigne, vol. iii. p. 174.

the third parallel is commenced, because, he observes,^a "the attack has not till then trenched upon the limits of the place."

36. We gain experience by consulting the journals of sieges; for it is from these that the great masters of the art have compiled their treatises. These, and our own experience, teach us, that direct fire, of both artillery and infantry from the place, is of the very greatest importance; and we shall show that it may be maintained without the certain ruin of the ordnance which give it, or such severe loss of infantry, as should lead us to abandon so formidable a feature of defence.

37. Let us consult the most experienced authors. We find them speaking in the following terms:—

M. Vauban says, "This work will not be so easily accomplished as at the commencement of the siege, on account of the labour which augments as they (the besiegers) approach; and of the fire from the place, which becomes more dangerous and destructive."^b

M. Bousmard directs, "That when the fire from the place has forced the enemy to resort to the process of the sap, the heads of the saps should be *cannonaded* with the greatest vigour, to endeavour to prevent the besiegers from advancing by day."^c He also recommends "a heavy fire of musketry and artillery to retard as much as possible the construction of the second parallel;"^d and directs "that the artillery should fire *à ricochet* in the direction of the capitals, that is on the zig-zags, and *direct* on the parallels."^e

M. Cormontaigne recommends "an incessant *cannonade* on the approaches," which, he says, "will force the enemy to construct other batteries, to endeavour to silence those of the place. All the cannon of the place," he observes, "should be directed on the zig-zags, on which a general *ricochet* fire should be kept up, together

^a Carnot, p. 412.

^b Vol. ii. p. 116.

^c Vol. i. p. 161.

^d P. 196.

^e "Yen d'artillerie à ricochet, et à cartouches, sur les capitales. Grand feu de mousqueterie des chemins couverts. Feu de mortiers et de canon de plein fouet sur les batteries assiégeantes."—P. 197.

with a brisk fire of musketry, abandoning for the present every other object." ^a

"As soon," says St. Paul, "as the besiegers debouche from the first parallel, the besieged should direct all the fire of the place, as well ricochet as *direct cannonade*, on the approaches; ^b and when the enemy are about to construct the second parallel, the besieged should add the fire of musketry to the other means of defence;" ^c and he remarks, that "the defensive dispositions against the third parallel consist in knowing how to employ properly, and successively, different sorties, fire of musketry, and artillery, directed against the heads of saps, unfinished works, covering parties, and working parties."

38. That several guns will be dismantled and rendered unserviceable during this period of the siege we admit: St. Paul allows that one-sixth of those on the fronts attacked will be dismantled; but great advantage will be reaped from this sacrifice, if they have been properly used; and the stores of the place should be calculated to replace the loss. Unless means be exposed to risk, they are not in general effectually used; and there cannot be any doubt, that if direct fire, both of artillery and musketry, be not liberally resorted to, an attack conducted by vigorous intelligence would proceed with a rapidity for which no determination or skill in the later stages of the defence could make up. M. Carnot asserts, ^d that his mode of defence renders the crowning

^a "Si l'on a pu sans danger laisser quelques pièces en batterie dans les parapets, tirant de ces pièces sans relâche sur la tête des zig-zags, on contraindra bientôt l'ennemi à construire lui-même de nouvelles batteries pour leur en imposer. Toutes les autres pièces de canon de la place seront également dirigées sur ces nouveaux zig-zags, que l'on battra comme nous l'avons dit: les chefs doivent veiller à cet article pendant tout le cours des approches.

"On donnera l'ordre aux batteries pour bien éclairer le travail des zig-zags de la nuit prochaine: on y fera pointer tous les ricochets et diriger toute la mousqueterie, abandonnant tout autre objet pour ne penser qu'à celui-là.

"La sixième nuit on s'opposera, comme nous l'avons dit, de toutes ses forces aux progrès des zig-zags, après que les patrouilles seront rentrées."—Vol. iii. p. 198.

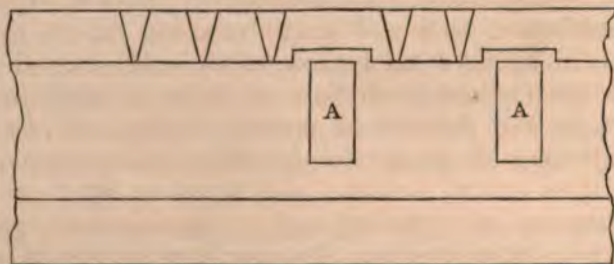
^b 'Traité Complet de Fortification,' p. 476.

^c Ibid. p. 478.

^d Page 329 of his work.

of the covered way, and consequently the establishment of the breaching-batteries impossible: if this were so, we should permit him to despise all the earlier operations of attack; but, doubting the impregnability of a place so defended, we seize the advantages he relinquishes, and proceed, with confident hope of success, in an enterprise which we consider already far advanced, although he may affect to think it but just commencing.

39. As soon as the enemy's ricochet batteries open, the ordnance should be removed from the barbets, and the guns placed to fire, through embrasures, on the zig-zags. These guns should not be used to cannonade the batteries of the enemy, but to retard as much as possible the progress of the trenches: and the author is convinced that a sufficient number of pieces of ordnance may be preserved for this purpose, notwithstanding the formidable ricochet fire of the besiegers; for one or two, placed in the salient angles of the bastions and demilunes, will be pretty well covered by the adjoining faces; and several pieces, placed upon the faces, may be covered by traverses as at A, A, fig. below. It is true that



these lessen the capabilities of defence, by the space they occupy on the rampart; but as that space is chiefly required for musketry, we may, by a very simple expedient, provide for this, by making cuts about three feet wide, within the interior slope of the parapets, opposite to the ends of the traverses, placing infantry at pleasure in these spaces. Guns may also be placed on the curtains in situations which cannot be directly

battered at all, nor seen obliquely unless the demilune have flanks. M. Cormontaigne, in his '*Mémorial pour la Défense des Places, et sur l'Usage à faire de l'Artillerie, pendant un Siège,*' makes urgent reference to this application of ordnance; and we call in the aid of his opinion in the following quotation:—"When the enemy is in a situation to counter-batter the faces of the bastions, there is no part of the ramparts so proper for placing artillery as the curtain: it cannot be directly battered, because it is covered by the ravelin; nor can it be cannonaded obliquely, unless that work have flanks; and, on the other hand, ordnance placed on the curtain may be directed on the zig-zags. By placing the ordnance on this part, the faces are left clear to receive more infantry, the fire of which is of such importance to support the defence of the covered way."^a

40. In short, without direct fire there can be no accuracy. The uses of shells fired at elevations, in the defence of places, have had a full share of the consideration of those who have written on this important subject. M. Cormontaigne says that, "shells fired in that manner do little injury, either to the trenches or to the besiegers; that not more than one in a hundred fall in their works."^b Another celebrated work^c contains an excellent observation in regard to the *secondary* uses of mortars in the defence of places. "Mortars are very useful, because they may be placed in less exposed situations than guns; but the ranges of mortars are so uncertain that, though they may be considered as powerful arms to *second* cannon, they cannot supersede them." This is well known to every man of experience, and we might quote our own practice instead of such authorities, to show it; but as M. Carnot is fond of appealing to these authors for support, and may undervalue illustrations from British practice, we refer him to authorities

^a Vol. iii. p. 195.

^b Vol. iii. p. 189.

^c 'Traité de la Défense des Places, avec des Réflexions sur les Principes de l'Artillerie,' p. 94.

which he cannot object to receive, because he quotes most of them himself.

41. Were it consistent with the arrangement which the author has prescribed to himself, he would notice here the accessory uses, recognised in all treatises, and practised on all occasions, of stone-mortars, small mortars, hand-grenades, &c.; but, as these come more properly under the next head, we shall not now enter further upon the particular uses of these natures of ordnance, than merely to remark that they are *reciprocal*. If the besieged fully man their covered ways, parapets, and ordnance, they will be at least as much exposed to the effects of vertical fire as the besiegers; and, if they do not, the attack may be pushed forward with less circumspection, and consequently with greater rapidity. M. Vauban admits fully the use which may be made of vertical fire in attack, when he says, "As stones and grenades discharged from mortars are more destructive than shells, the besieged should provide themselves with wicker bonnets wadded in the inside, and the bottom well stuffed with hay." Such a cover for the head would be an effectual protection against M. Carnot's vertical fire. M. Vauban proceeds further, in admission of the uses of vertical fire in attack, to direct that, "splinter-proofs should be constructed at the bottoms of the ramparts, in the ditches, and covered way, for shelter from the shells and stones thrown in by the besiegers."* Yet M. Carnot quotes this passage (p. 317) as recommending the use of stone-mortars *in defence*, and, suppressing the last part, makes no reference to the reciprocal uses of this accessory. M. Cormontaigne observes upon the use of stone-mortars in attack, that "if they be well served, particularly during the night, they will do more

* "On se fera de petites places, de distance en distance, joignant le parapet, qu'on recouvrira par les palissades appuyées et rangées en appentis, et par les loges de rondins de bois et de madriers enfoncées dans les taluts des remparts, et au bord des fosses et des traverses, comme on en voit dans la planche 3. Quand l'ennemi commencera à tirer des bombes et des pierres, il faudra tenir la garde dans ces lieux couverts."—'De la Défense des Places Fortes,' vol. ii. p. 116.

execution than guns or mortars, and facilitate infinitely the attack of the covered way."^a

42. The appeal which M. Carnot makes^b to the powers of the engines used by the ancients, in support of his reasoning, is most absurd, and for any purpose of practical utility undeserving of notice; but, in analyzing his treatise, we are obliged to answer his supporting illustrations.

M. Carnot quotes M. Folard's well known prejudice in favour of the arms of the ancients, to support the new doctrine; but M. Folard's enthusiastic, fanciful mind, never led him to recommend their adoption, excepting as accessories to second modern weapons: he only asserted the superiority of the ancient arms over muskets; but such superior powers as M. Carnot ascribes to discharges at high elevations from cross-bows, scorpions, &c. would indeed render fortified places, so defended, perfectly impregnable. He says, (page 348):—"A man armed with a cross-bow may easily discharge an arrow every minute, which is 1440 in twenty-four hours. Supposing then that the besieged employ 200 cross-bow men, there would be 288,000 arrows discharged from the ramparts in that time. But it has been shown," he says, "that at least one arrow in every 180 will take effect, whence of the whole number thrown, 1600 will do execution, from which it follows that 1600 men will be put *hors de combat* daily. Supposing this *défense rapprochée* to continue only ten days, the besiegers," he calculates, "will have lost 16,000 men, and it would be easy to double the result by augmenting the number of cross-bowmen."

43. In opposition to these wild speculations in favour of resorting to the practice of the ancients, we must, as he has led us to it, make some observations on the influence which the invention of artillery has produced on the methods of conducting, and the duration of sieges. The first use made of artillery in Europe was by the Moors at Algeziras, which town was besieged, in

^a Vol. ii. p. 126.

^b Page 347.

1343, by Alonzo King of Castile; the defence was protracted to a very long period by the advantages which the besieged derived from the use of these formidable engines. This celebrated siege, at which were displayed on both sides many remarkable instances of courage and skill, attracted the attention of all Europe, and adventurers from most parts of the continent voluntarily served under King Alonzo's banners. The superior effects of fire-arms in defence were thus witnessed by a number of warriors from most of the European nations, who, on returning to their respective countries, soon circulated the destructive secret; and accordingly we find that, very soon after this memorable siege, artillery began to be used in most of the armies of Europe. At Cressy, in 1346, by the English; at the siege of Romorantin, by the Black Prince, in 1356; and at the defence of Chioggia, in 1379, by the Venetians. These were events in which the introduction of a new arm, totally subversive of all the ancient modes of warfare, had, like every other novelty, to combat with deep-rooted prejudices in favour of the existing practice, which, slowly yielding to the gradual innovation, long acted in concert with it, exhibiting comparative effect, and powerfully attracting general notice. That this was the case, we learn from the tone in which the writers of that time exclaim against the introduction of artillery, as a total violation of all fair warfare. But, setting aside general reasoning, upon a subject which may be better supported by an appeal to facts, we are called upon, by M. Carnot's observations, to take a view of the modes of attack and defence practised by the ancients.

44. The great cause of the superiority of defence over attack, previous to the invention of gunpowder, arose from the insufficiency of the catapultæ and balistæ of the ancients to breach walls, and, consequently, the necessity of advancing to the very base of the enclosure, in order to apply the battering-ram. This formidable engine could neither be placed nor worked, whilst the besiegers remained themselves on the tops of their

walls, without very severe loss; and many protecting precautions were resorted to in order to cover it from the showers of missiles to which it was exposed, and to defeat the expedients practised to disturb its operation. Thus the chief purpose of the works of attack was to favour the approach of the ram. The earthen mounds, and towers, which the ancients constructed to command the walls of the town, were raised to force the besieged to withdraw from them; whilst the *tor-toises*, mantlets, and galleries, served to cover the assailants from the missiles discharged from behind the rampart, or which might still be thrown from its summit. When the besiegers had succeeded in filling up the ditch, and had placed the ram in battery, a place seldom refused to capitulate, unless the part threatened to be breached was cut off by an interior wall or retrenchment. This general principle of attack was observed with little variation at the earliest sieges we read of; and we find that Demetrius and Epimachus in besieging Rhodes, Marcellus and Appius in attacking Syracuse, only improved machines which had been used long before, and are mentioned by writers of the earliest antiquity.

Thus, a simple wall with towers was sufficient to resist for a considerable time the efforts of a large army, and force it to undertake immense works, before any attempt could be made to open a breach. The difficulty of effecting this constituted the great security of places: it either exposed the assailants to be crushed by missiles thrown from the ramparts, or it obliged them to undertake stupendous works to cover the advance, and protect the operations of their breaching-engines. Such, for instance, as the tower of brick which C. Trebonius caused to be raised at the siege of Marseilles under cover of a vinea, (a roof or covering of planks and hurdles,) to command one of the towers of the place; the immense mound thrown up by Flavius Sylva at the siege of Massada, and the tower erected upon it to command the place; the prodigious pile, eighty feet high, and three hundred wide, constructed by Cæsar in twenty-five

days at the siege of Bourges; and many other vast works used in besieging places.

45. When fixed structures were not found to succeed, the alternative was still more astonishing, *viz.*, moveable towers, some with a battering-ram below; others furnished with casting-bridges to lower upon the walls, and thus form passages to the place. The moveable towers with casting-bridges, used by the Romans at the siege of Jerusalem; Cæsar's *turres mobiles* used at the siege of Namur; the Helepolis of Demetrius at the siege of Rhodes, were all stupendous machines, whether we consider their structure or the prodigious force required to move them. Such works are indeed truly astonishing; and, having been resorted to for the purpose of counteracting the effects of what M. Carnot calls vertical projections, are certainly calculated to give a strong impression of the power of ancient arms in *ancient sieges*; but the calculation he makes of their powers, (p. 348,) for *modern defence* is perfectly absurd.

46. M. Folard has indulged some fertility of fancy in his treatise on the modes used by the ancients in attacking places: he endeavours to show, that trenches, galleries, parallels, or places of arms, were applied much in the same manner as at present, in order to approach to the walls of the place. The ancients undoubtedly used various expedients to cover themselves against the missiles of the besieged—such as the Vineæ, the Pluteus, the Musculus, the Porticus, the Testudo, &c.; but they certainly did not advance towards the place by digging trenches. The attack was always made by first establishing a command over the walls of the place. This was generally effected by raising mounds of earth, timber, &c.: when this mode was not practised, towers were either erected close to the walls under vineæ, or constructed at a distance from the place, and moved forward by mechanical means. The galleries which M. Folard converts into parallels and approaches, in his interpretation of Polybius's account of the siege of Ægina, were only covered communications made as usual under *musculi*, *testudines*, or some other defensive

machine. The obscure account which Polybius gives of this siege^a is but a fragment, and does not bear the superstructure which M. Folard has founded upon it.^b It appears, even from this fragment, that the attack was commenced by pushing forward a musculus and a battering-ram against each of the two towers attacked; and that the communications were made afterwards by tortoises covered with hurdles.

47. M. Carnot has imbibed many of these prejudices in favour of the defensive powers of ancient arms. M. Folard says, "all prejudice apart, this arm (the cross-bow) is infinitely more destructive than our musket; its force being at least equal, and its effect more certain." But our author's assertion that 200 *arbalétriers* would put 1600 men of the besiegers *hors de combat* daily;^c is going much further than ever the prejudiced Folard ventured to retrograde upon the path of improvement. M. Guichard gives more correct readings of the practice and character of ancient sieges; and to all those on whom the reasoning of Carnot, supported by the fancies of Folard, have had any effect, we recommend the perusal of that work, as a sensible antidote. M. Guichard says, (page 13,) "I have examined, in the original language, the passages upon which he (M. Folard) supports his system, and soon convinced myself that there is no authority for what he asserts, and that the authors express themselves very clearly upon the subjects they have undertaken to explain."^d We might extract many other observations bearing with equal force upon the erroneous conclusions M. Folard has drawn; but it is quite idle to compare modern and ancient modes of warfare, for any purpose of practical utility. The invention of gunpowder soon turned the balance in favour of attack, and the introduction of the ricochet system has confirmed this superiority. All M. Carnot's theory and ingenuity are insufficient to restore the equilibrium or destroy this preponderance. His suggestions, if

^a Book ix. chap. 8.

^c Ibid. p. 60.

^b Folard's Polybius, vol. ii. p. 169.

^d "Mémoires Militaires."

strictly followed, would on the contrary turn the scale more in the direction of their present inequality, from the little vigour he proposes to exert in the first stages of defence. The introduction of artillery gives a momentum, equal to that of a battering-ram, to a cannon ball, which may be projected with such a degree of accuracy as to enable us to injure defences at very considerable distances. The largest battering-ram we read of was 120 feet long, and, including a head of cast iron of $1\frac{1}{2}$ ton, was about 35,000 lbs. weight. Supposing it to be worked by 500 men, each exerting a force of 70 lbs., the force or momentum produced by their action, when the ram moves one foot per second, is about 35,000 lbs.—The momentum of a 24-lb. shot, moving with a velocity of 1500 feet per second, is about 36,000 lbs.

48. The invention of gunpowder thus proved utterly destructive of all former modes of war; and the gradual improvements made in artillery, and in the science of attack, explain the causes of what M. Carnot considers so extraordinary, when he asks, (page 327,) “from what cause does it happen that the strongest places are commonly taken after sieges which rarely exceed six weeks, and generally last only 22 or 23 days?” The use of gunpowder is the cause which has produced the short duration of modern sieges: and it is quite useless and absurd to attempt any comparison between the obsolete and the existing practices, with any hope of improvement.* In the present excellent state of artillery and of the science of attack, sieges of places, as far as they are strong from art only, are the most certain operations of war, if attacked with sufficient means; and we may rest assured that, when these enterprises fail, it most commonly arises from having undertaken them with inadequate resources.

* “Quoique les belles défenses n’aient jamais été communes, il faut convenir qu’elles étoient cependant moins rares, je ne dis pas chez les anciens dont les mœurs, les usages, le système de guerre, la nature de leurs armées et l’espèce de leurs armes étoient si différens des nôtres, qu’il seroit ridicule de vouloir établir une comparaison entre ces temps reculés et l’époque présente, mais chez les peuples modernes, qu’elles ne l’ont été dans les derniers temps.”—*St. Paul, ‘Traité Complet de la Fortification,’* p. 384.

49. The bearing of M. Carnot's reasoning is to ascribe the greater duration, and more frequent failure of sieges in ancient than in modern war, rather to superior vigour and resolution displayed by the defenders than to any inherent superiority in the means used in modern attack. It is upon this conclusion that he grounds his project for adopting vertical fire as the *basis* of defence, and the use of the "*armes blanches*" for its *consummation*. Let us, therefore, take a view of the duration of some of the most memorable sieges that took place before artillery was used, and compare them with the periods of resistance which the same places made against the modern means of attack.

50. Calais was reduced by Edward III. by famine, every attempt to take it by force having failed. The Duke of Burgundy also failed before it in 1436. But the Duke of Guise attacked it in 1558, breached the walls with his artillery, and took it in eight days.

Edward III. besieged Tournai in 1350 with a very large force, but failed in the attempt, and was obliged to extricate himself from a very critical situation by concluding a truce which relieved the place. But in 1581 it was breached by the Spaniards under the Prince of Parma, after a few days of open trenches: the assault was repulsed, but the place, incapable of further resistance, was, nevertheless, forced to surrender.

The first use of artillery made by the *English* at sieges was by the Black Prince at the siege of Romorantin in 1356. The first attempts against it were made in the old way, and repulsed; upon which the engineers caused some batteries of *cannon* to be erected, by which the place was set on fire, and soon forced to capitulate.

Thouars (formerly considered the key of Anjou and Poitou) was besieged by the Connétable Duguesclin in 1372, and soon reduced to extremity by the fire of the besiegers; the besieged, "*ne trouvant plus d'asyle contre l'artillerie française,*" agreed to capitulate, if the King of England's army did not arrive before the 29th of September: it did not arrive, and Thouars surrendered.

Belisarius attacked Naples in 536, and, having failed

in every effort of force, was about to abandon the enterprise, when the discovery of an aqueduct or conduit, leading to the place, suggested an attempt by stratagem. The conduit was enlarged, and in this way 200 men, being introduced into the town, obtained possession of two towers, and at length the place was taken.^a But Ferdinand's great Captain Gonsalvo de Cordova reduced Naples *by means of gunpowder*. Upon the approach of the Spaniards, the French retired into two castles, and made a defence which would most probably have resisted the means used by the besiegers; but an intelligent warrior, Pierre de Navarre, having communicated to Gonsalvo the nature and use of *mines*, was employed to try their effect upon this occasion. They were applied with success, and the place was taken in consequence.

The defence of Rhodes is justly celebrated as perhaps the most remarkable in ancient times. Demetrius, surnamed Poliorcetes (destroyer of towns), after being a whole year before it, was frustrated in his attempt in consequence of the destruction of his stupendous works by fire. He then pushed forward his celebrated Helepolis, or movable tower, the effect of which was defeated by a Rhodian engineer, who having caused a subterraneous gallery to be dug in the ground over which the tower was to be dragged, it sunk in the earth, and could not be moved.^b—The siege was raised in consequence.

In 1308, Rhodes was besieged by the knights of St. John of Jerusalem, assisted by most of the powers of Europe, and the place was not finally reduced until the expiration of four years. But it was taken in a comparatively short time by Sultân Soleyman I. in 1522. The besieged at first made many successful sorties, which so discouraged the Turks that Soleyman called before

^a It is very remarkable that, in 1442, Naples was taken much in the same way by the King of Arragon. Prince Eugene's success in getting a considerable number of men introduced into Cremona through a common sewer, is another remarkable instance of this nature at sieges, though he did not ultimately succeed in taking the place.

^b Vegetius. But Vitruvius says this was effected by throwing quantities of water, mud, and loose dung, upon the ground over which the tower was to be dragged, to destroy the solidity of the foundation.

him, unarmed, those whom he considered to have behaved ill, and surrounding them with his guards, reproached them in the strongest terms, and even threatened them with instant execution. This produced the desired effect, and the subsequent conduct of the troops washed off the ignominious stain. The trenches were pushed forward with vigour, and so guarded that sorties could not be hazarded. A large breach was then made by *mine*, and an assault attempted: it was repulsed. A general assault was then made; this also failed: repeated attacks were carried on till the middle of winter, when the place was obliged to surrender from the effects of the mines and ordnance, and from the want of amunition on the part of the besieged.

51. M. Carnot quotes a great many instances of brilliant defences from ancient and modern history to support his doctrine, and to show that the defence by "*armes blanches*" is more brilliant, efficacious, and successful than by fire-arms. Some of these instances are very partially stated: for, to make a fair comparison of the means of attack and defence, he should not have adduced sieges which were raised in consequence of succours thrown in, nor should he have omitted to notice any gross error or weakness on the part of the besiegers that can account for the failure of the enterprise. Let us look a little into the instances mentioned by M. Carnot, and we shall discover many circumstances destructive of an impartial comparison of the pure question of attack and defence. It is true that some of these places had held out a considerable time before the relieving operation took effect, but it does not follow that they would not have fallen: and it appears, from the very cases M. Carnot has quoted, that, from the time artillery began to be used, sieges became shorter in proportion as gunnery was improved.

M. Carnot quotes the following, among many other sieges.

REMARKS.

Rennes; besieged by the Duke of Lancaster, 1357: not taken.

The place was relieved by Bertrand du Guesclin, who threw in large succours.

Compiègne; besieged by the English, 1430: raised.

By the advance of Vendôme and Xaintrailles.

Belgrade; besieged by Sultan Amurat II. 1439: raised.

Was actually taken; but afterwards lost by the misconduct of the troops, who, thinking themselves masters, imprudently dispersed about in the town.

Beauvais; besieged by Charles le Hardi, 1472: raised.

Misconduct. The place was not completely invested, and succours were thrown in. Charles, seeing his error when too late, raised the siege.

Mezières; besieged by Charles V., 1520: raised.

Defended by the Chevalier de Bayard. In three weeks the place was breached, and in extremity; but was saved by a singular stratagem, which deceived the besiegers, and succeeded in occasioning the raising of the siege.

Marseilles; besieged by Bourbon, 1524: raised.

A breach made; but the place relieved by Francis I., who, by destroying the mills, forced the Constable to raise the siege without a battle.

Landrecies; besieged by Charles V., 1543: the siege failed.

Succours thrown in by Brissac without the loss of a man; and again relieved by Martin du Bellay.

Landrecies; besieged by Prince Eugene, 1713: raised.

By the victory of Denain under Villars.

Metz; besieged by Charles V., 1552: raised.

Misconduct of the besiegers in being deceived by a letter sent by the governor to his King, purposely to be taken, stating that, as the enemy had attacked on the strongest side, he was easy: the plan was altered as expected, and the attack directed against a stronger part. Although breached, the place was not assaulted. Misconduct evident from Charles's speech to his troops.

Harlem ; besieged by the Spaniards, 1573.

Siege badly conducted. Attempt to take a ravelin, not breached, by a portable bridge, which not being long enough, the attack failed. The place was not completely invested, and succours of every kind thrown in ; but it was at length taken.

Ostend, besieged by the Spaniards, 1601.

The besieged constantly succoured by sea.

Rochelle, Louis XIII., 1627.

Reduced by famine in strict blockade.

Candia, defended by the Venetians during two years, against the Turks, 1667.

Defended by Morisini. Succoured by the French under the Duc de Noailles, who in a sortie destroyed the works, spiked the cannon, forced the lines of the besiegers ; but a bastion being destroyed by the blowing up of a magazine, from the carelessness of a French soldier, the Turks took advantage of the confusion, and made a successful attack : upon which Noailles embarked his troops, and the place surrendered. Here the French first learnt the use of parallels, and thence improved in the science of attack, which Vauban perfected.

These observations will show that M. Carnot's historical illustrations are not impartially applied.

52. We now come to the period which proved further destructive of the balance between attack and defence, viz., the introduction of the ricochet system by Vauban.

Maestricht, 1673.

Invested June 10th, trenches opened on the 17th. Vauban here first used parallels and places of arms to repel sorties, which had been introduced at the siege of Candia, 1667, by a renegade Italian engineer ; from this time sorties have not usually been successful. The place capitulated on the 29th.

Valenciennes, 1677.

Trenches opened on the 9th of March. On the 17th a crown-work carried, and the troops penetrate into the place, gain the ramparts, turn the guns, descend into the place after the besieged; pursue them from retrenchment to retrenchment, from street to street, gain possession of some houses, are supported by fresh troops, and the place is forced to surrender at discretion.

Philipsbourg, 1688.

Taken in twenty-four days.

Ath, 1697.

Invested 15th May; on the 27th, ricochet batteries opened; June 1st, battery in breach opened; on the 5th, the place capitulated.

Brisach, 1703.

Taken in thirteen days.

53. In regard to the display of vigour and resolution in personal conflict, which M. Carnot seems to think comparatively deficient in modern defences, it is clear that the invention of gunpowder has narrowed the opportunities of displaying those qualities in the operations of a siege, properly conducted, more than in any other military enterprise. There is no opportunity for personal conflict excepting in sorties, which, we have already shown, prove too frequently but a waste of life and valour, and in the defence of breaches, where also there is that to encounter which the ancients were not exposed to. M. Carnot's object in quoting so many sieges is to show that the defence of places by "*armes blanches*" has constantly been more brilliant, more efficacious, and of longer duration than by *armes à feu*. "What," he says (p. 239), "has the invention of powder, or the new process of attack, to do with the vigour and resolution that were used by the ancients? These," he observes, "may alter the means, but not the principles of resistance."

54. Now here we differ from M. Carnot; and, to close properly with this assertion, we have rather fully compared the ancient with the modern means of attack, for

the purpose of showing that the general principles as well as means of defence *are* altered, and that both are inferior to those of attack when directed by scientific intelligence, and furnished with sufficient means. What can personal vigour and resolution do against the establishment of the ricochet batteries, and all the process of attack, until it come near enough to be checked by sorties? The defence by "*armes blanches*" can be only applied to the defence of a breach; but a breach may always be made, whatever be the vigour, resolution, or strength of the garrison. The only means to oppose and retard the opening of a breach are by a powerful fire of artillery in the first instance, then by counter mines, and occasionally by sorties. These may, at a great sacrifice, retard the operation, but cannot altogether defeat it. Do not these alter the principles as well as the means of defence? The sieges of the ancients gave occasion for a great many personal conflicts from the beginning of the enterprise; and so did modern sieges until parallels or places of arms were formed, to protect the approaches and repel sorties: but there is now no such field for personal prowess, and a place may certainly be breached and exposed to the consequences of an assault without giving the besieged any favourable opportunity of displaying personal exertion with "*armes blanches*." Up to this period a siege is now carried on, as the French say, "*par industrie*," which, instead of being secondary, as M. Carnot says, to the objects of personal valour, affords the means which introduce the display of it; and we cannot see that his reasoning can attach to anything but the defence of a breach. With this, also, gunpowder has, or at least ought to have, a great deal to do; for the guns that made the breach can render it practicable: they can prevent the besieged from closing it by exterior obstacles, and the interior defences may be molested by shells, stones, &c. M. Carnot applies personal valour and determination less, in the first instance, to the defence of a breach than we should do. He proposes (p. 333, 4to. edition) to have fifteen or twenty "*pierriers blindés*" ranged round the

breach as a focus, and to keep near them, also under cover, a *corps d'élite* ready to march forth. When the besiegers' troops put themselves in motion to advance to the assault, M. Carnot recommends that the troops should be withdrawn from the rampart, in order to allow the stone-mortars to act. It is evident, he observes, that the enemy either will not arrive, or if he does, that it will be in disorder, after immense loss from the fire of the stone-mortars.

"Upon this the fire should suddenly cease, the *corps d'élite* march forth and charge the enemy, who will very soon be driven from the field of battle, whilst a good sortie will take them in flank and rear, destroy their *épaulement*," &c. This is indeed a sweeping clause in M. Carnot's theory, and there needs no comment to show that it is the most fallacious part of his doctrine. The way to oppose an assault is undoubtedly to render the breach as inaccessible as possible, by every obstacle that can be applied, and to hurl upon the storming party quantities of stones, live-shells, grenades, combustibles, &c.; and some of the expedients proposed by M. Carnot for these purposes, and practised by the French in the Peninsula, are among the best parts of his elaborate treatise. He recommends (p. 310), that the breach should be strewed with crow's-feet, harrows, *chevaux-de-frise*, &c.; and that when the assault is about to be made, or expected to take place, the besieged should form a barrier on the summit of the breach, of strong six-pointed crow's-feet, made of wood armed with iron points, firmly fastened to each other: that when the storming party advances to the assault, it should be assailed with a prodigious quantity of combustibles and any other destructive missile that can be procured; and that a deep trench, previously dug and filled with tarred faggots, and other combustible materials, should be set on fire when the storming party is about to mount the breach. He also recommends (p. 297) cuts to be made into the parapet, on the flanks of the breach, from which the besieged can either fire, or drop shells upon the assailants: an expedient which,

after the breach is carried, will prevent the enemy from extending himself, by sapping in the parapet, toward the shoulders and gorge of the bastion, to the attack of the retrenchments. But whatever obstacles be applied to close the breach, they will inevitably be destroyed, broken, or deranged by the heavy fire from the breaching-batteries established on the crest of the glacis, which is always the immediate prelude to an assault. Consequently, little reliance should be placed on any other means than the personal valour and determination of the troops actually placed behind these obstacles, who should *there* use the most determined, devoted exertions to prevent the enemy from gaining a footing on the breach. According to M. Carnot's method of opposing an assault, a footing might be gained, and a lodgment partly formed, before the corps d'élite could be drawn out from their cover, and march forth to "balayer" the rampart; and when once a footing is obtained, or a lodgment made, it is not easily recovered by the defenders, if proper measures have been taken to support the assault: the attempt is always very bloody, and seldom successful.

55. M. Carnot inserts a long quotation from the Sieur Antoine de Ville's '*Ingénieur parfait*,' published in 1629, which, he says, only requires some *modifications* in consequence of the improvements that have been made in fire-arms since the period at which this work was written. This passage commences in the original (book iii. part ii. p. 372) with an enunciation (which M. Carnot suppresses, as he does several other parts of the passage), which shows how completely the author's directions must be considered, as indeed they are, obsolete. "In proportion," says M. de Ville, "as the enemy makes a breach, the besieged should endeavour during the following night to undo his work, to restore, and re-form the rampart." Whoever reads this passage in the original will perceive that very little of it can apply to the defence of a breach made by a battery established on the crest of the glacis, in a face which has been ricoched from the commencement of the siege,

and whose acting flank is directly counterbattered, and also enfiladed from the third parallel. It were madness indeed to attempt to defend a breach made in this regular way, unless the besieged have a retrenchment. M. Carnot may adduce, and the reader of this work may recur to, the sieges made in the Peninsula, in opposition to this assertion; but we have the public authority of a very distinguished British Engineer (Colonel Sir John Jones) to remark, that those sieges having been undertaken and executed under circumstances and deficiencies which did not admit of regular attacks according to established rules, cannot be received as cases which afford any reason for departing from long-established practice; and that the defence of the breaches at Badajoz, which has thrown some *popular* lustre on M. Carnot's work, could not have succeeded against an attack conducted, throughout, according to a regular process. M. Carnot may perhaps dispute illustrations from British talent and experience, or we should have presented him with further references to facts contained in Colonel Jones's excellent work, in support of other parts of our reasoning.

56. In recapitulating his new principles of defence, M. Carnot says (p. 422): "If, when the besiegers had established their ricochet and mortar batteries, the besieged had withdrawn from the ramparts all their ordnance, excepting that placed in the 'batteries blindées' and casemates,—if he had also withdrawn all the men whom he could not put under cover from the fire of the enemy, and *that of the place*,—there would have remained for the last periods of defence many disposable pieces of ordnance, and a great many brave men then

may be true; but the corresponding conclusion is, that such a forbearing system would very much retard the early stages of the siege, whilst it would prevent the ulterior operations. For the descent of stones are exceedingly un-
the descent of 4-oz. balls, discharged

from mortars, would not put men *hors de combat*. If the weight of the balls be increased, the number must be diminished accordingly, and the chances of hitting be diminished in proportion.

57. M. Carnot closes his subject by noticing, and certainly favouring, (p. 349) a singular idea of a M. Flachon de la Jomarière, who proposes to pour upon the besiegers, when they are about to crown the covered way, an enormous quantity of water from powerful engines, which, he says, will make the soil so liquid that it cannot be worked! It may be said, that if any commentator on M. Carnot's work had ventured such a satire upon his project, he might fairly be suspected of a wicked design to treat the author and his system with the greatest contempt and indignity.

58. There can be no doubt that a place, defended in the manner M. Carnot proposes, would be more easily reduced than if defended with intelligence, industry, and vigour, in the way directed by our great masters. The author admits, however, that stone-mortars, grenades, &c., have not been sufficiently used in recent defences, nor provided in the equipment for attack; but this is an error in practice, and not a deficiency in a written principle: for (as will be shown hereafter) the uses of these powerful accessories are recognised and enforced by all the great masters of the art, quite as far as they can be adopted with any advantage.

59. Having endeavoured to show the fallacy of M. Carnot's proposition for adopting vertical fire as the basis of defence, we shall proceed to inquire, in the next place, Whether the different sorts of fire which he includes under this general head, might, with any advantage, be more generally used than is directed in all treatises on attack and defence.

In considering this, let us first consult the works of all the great masters of the art, as to the application they propose of this powerful accessory; and, receiving their directions upon this subject as established principles for regulating defence, proceed to consider whether

vertical fire ought to be more generally applied than they recommend; and, if so, whether in M. Carnot's plan for covering troops and ordnance from the fire of the besiegers, there be anything very new, either as to the situations he points out, or the objects and necessities for erecting these covers.

60. In quoting Vauban's observations, M. Carnot carefully keeps out of sight some material parts of the passages to which he refers, because if he had given them entire they would divest much of his reasoning of all the charm of novelty. M. Vauban says (*Traité de la Défense des Places*, p. 109, édition par Foissac), "the first precaution in defending a place is, in my opinion, to place few people directly opposite to the parts to which the enemy is advancing, and to relieve them often, making the men keep close to the interior slope of the parapet, and forming the main bodies of the guards or troops on duty, on the right and left of the attacks.

"The second precaution is, to construct, behind the parapets, triangular splinter-proofs, made of timber eight or ten inches thick, to cover the ordnance and troops from the stones and shells thrown in by the besiegers.

"The third precaution is, to make small excavations in the interior slope of the rampart, covering their entrances by splinter-proofs.

"The fourth precaution is, to have in the place as many mortars as cannon, one-third iron for throwing shells, and two-thirds brass (with small chambers) for throwing stones and grenades. All these mortars should be mounted on wooden beds easily transportable, and their platforms, side-arms, and stores, always in a state and condition to be removed at pleasure.

"The expense of this equipment cannot be very great, and will be productive of great service; for if the enemy use stone-mortars, the besieged, being also provided with them, may give him more stones, as well as grenades, in return: from which it will probably happen that the enemy, suffering severely from this

retaliation, will cease this nature of fire, not having stones so much at hand as the besieged, who besides may cover themselves in the huts already described."

61. M. Carnot, in quoting this passage,^a omits the three first paragraphs altogether, and materially alters the termination of the last. M. Vauban's *petits couverts* are not made near the parapet, as M. Carnot states: they are constructed at the foot of the interior slope of the rampart; and are, in many respects, so similar to M. Carnot's system of *blindages*, that he suppresses the main part in order to conceal the resemblance, and alters the termination of the sentence for another purpose. For this paragraph contains a very strong admission of the *reciprocal* uses that may be made of vertical fire, since it clearly expresses a readiness to abandon the use of stone-mortars in defence, if the besiegers will consent to relinquish it on their part. M. Vauban, we must recollect, was more experienced in attack than in defence: if, in the course of that experience, he had been much impressed with, or had ever witnessed, upon the whole, the superiority of vertical fire in defence, he would not have expressed himself in terms which, referring to the reciprocal uses that may be made of it, admit—what indeed must be evident to every experienced man—that the besieged are most exposed to its effects.

62. M. Cormontaigne's opinion and directions for the adoption of what M. Carnot calls vertical fire, in defence, are shown in the following extracts from the 'Mémorial pour la Défense des Places,' p. 199, vol. iii. :—

"All the ricochet-fire and musketry of the place should be directed on the working-parties employed on the zigzags; and as the enemy are now within about seventy toises of the crest of the covered way, the nine stone-mortars should be placed in the salient places of arms instead of the eight-inch mortars. For it must be remarked, that when a shell falls, the men who are near it are obliged to lie down to avoid the

splinters, as well as stones, which are blown about by the explosion : this therefore is the moment to use stone-mortars, the effect of which will be greater against men extended on the ground than when they are upright.

"Large grenades should be discharged from mortars upon the third parallel; and hand-grenades should be used against the double saps advancing towards the places of arms."

In the chapter on the provision of ammunition, &c. for the defence of a hexagon, we find the following item:—"A cart-load of stones will furnish about fifteen rounds; a sufficient number should be collected to supply 10,800 rounds."

The provision of shells is rated (p. 240) at 3240 eight-inch, and 1340 twelve-inch; 364 carcasses; and (p. 237) 8640 hand-grenades.

M. Bousmard does not descend so much into these details; but we can gather from his general directions what were his ideas of the *secondary* uses of elevated fire.

He observes,^a "Howitzers and eight-inch mortars should be placed in the salient places of arms to fire à ricochet, over the palisades, on the capitals, in which direction the shells will cross successively the zigzags of attack;" and, at page 205, he enforces strongly "the importance of elevated and vertical fire in defence." He observes in another part, "mortars and pierriers, being fired at considerable elevations, are more easily concealed and covered from the enemy's batteries than cannon, and, placed almost anywhere, will produce the advantage of reaching the enemy behind his parapets, epaulements, &c., and of destroying the galleries for the descent into the ditch, where they are not made under ground."

63. We extract the following passage from St. Paul,^b to show his opinion and application of vertical

^a "Essai Général de Fortification," ed. Paris, tom. i. p. 189.

^b "Traité Complet de Fortification," p. 471.

fire in the defence of a hexagon, (page 471).—"Six howitzers should be placed in the salient places of arms of the front attacked; and, together with light guns also posted there, keep up a cross fire, *à ricochet*, on the zigzags of attack. As soon as the besieged perceive that the besiegers have commenced the construction of the howitzer batteries in the half-parallels, to enfilade the branches of the salient places of arms, the ordnance placed there should be withdrawn to such situations on the ramparts of the body of the place as are most advantageous for obtaining good *ricochet* fire on the approaches—a most important object, since through the approaches all communication with the parallels circulates.

"Stone-mortars should now be used instead of mortars for iron balls. The short range of this nature of ordnance prevents their being used in an earlier stage of the siege: but, being capable of producing very great effect at short distances, they should now be put in activity as soon as possible. When the stone-mortars can no longer be used in the salient places of arms, they should be placed in the salients of the bastions and demilunes of the fronts attacked. This is the moment to give to this nature of ordnance all the activity it is susceptible of. For this purpose, it will be necessary to have large quantities of stones collected, not only in the salients of the bastions and demilunes, but also near the shoulders of these works; so that, when the assault takes place, the whole crest of the glacis may be covered with showers of stones, case-shot, and feux d'artifice.

"Mortars may now be used as pierriers, for it is no longer the time to throw single shells. As the fate of the place depends essentially upon the issue of the attempt to crown the covered way, the besieged should direct all their efforts against this critical operation.

"If the enemy prefer to attack the covered way by assault, all the fire of the place, as well musketry as ordnance of every nature, should open upon the columns of attack as soon as they begin to mount

the steps in the third parallel. But when the enemy have arrived near the crest of the covered way, the fire will suddenly cease, to enable the troops posted in the places of arms to meet the assailants upon the glacis. During this struggle, all the artillery of the place should keep up an active fire on the trenches, particularly on the zigzags, which the howitzers will *ricochet*:" the stone-mortars alone remaining inactive, lest the stones should fall upon the defenders as well as the assailants.

"When the besiegers have succeeded in crowning the salients of the covered way, whether by assault or by sap, the besieged, forced to abandon the salient places of arms, may now recommence the fire of the stone-mortars which were obliged to cease when the saps came so near as to render it impossible to fire upon them without injury to the troops placed in the salient places of arms.

"This is the moment in which the besieged should apply all his means of defence, to hinder, or at least retard, the lodgment on the crest of the glacis. No effort should be neglected—no means spared. Torrents of stones, grenades, combustibles, &c., &c., should be poured without intermission on the besiegers."

64. These quotations will show that there is nothing new in a *very general application of vertical fire in defence*. The extent and detail of means that should be provided for this purpose we learn from those works which are generally consulted, in estimating the ordnance stores required for the defence of a fortress. In the chapter on the *Approvisionnement des Places*, given in the French '*Aide Mémoire*,' we find the following proportion of projectiles:—

500 shells for each large mortar,
600 shells for each small mortar,
1040 baskets of stones for each pierrier,
3000 grenades de rempart,
20,000 hand-grenades.

Upon the use of the hand-grenades the '*Aide*

Mémoire' observes, (p. 448, vol. i.):—"The stone-mortars should fire 50 rounds a day from the time the enemy arrives at the third parallel. Two men in each of the five salient places of arms throwing 20 grenades an hour, for five days (during which the enemy is within reach of hand-grenades), will expend 24,000.

"Four men on each breach, throwing 20 grenades every hour for three days, will expend 16,280, supposing there are three breaches."

Durturbie, in his 'Manuel de l'Artilleur,' (p. 296), allows a greater proportion of shells, grenades, and stones than the 'Aide Mémoire;' and M. Coëhorn's opinion and application of small mortars are acknowledged in the general use of the 4 $\frac{2}{3}$ -inch mortar which bears his name.

65. There remains a very material observation which it is important to make (but which M. Carnot does not notice) as to the great uncertainty of practice with stone-mortars. M. Cormontaigne admits "that pierriers can only be used at very short ranges;—that if we were to attempt to employ them at greater distances, the increased charge would reduce the stones to powder, or break them into pieces so small, and scatter them so much, that very few would fall in the trenches." The fact is, that a charge of stones fired from a mortar must, at any range, be *extremely* uncertain, much more so than even the 4-oz. balls, and must scatter so much that but a very small proportion of them will fall in the trench aimed at; whilst a great many, falling short, will undoubtedly take effect upon the defenders in the advanced works over which the discharge is made—as, for instance, in using pierriers from the ravelin upon the trench cavaliers.* This arises from the diversities of weight, surface, angular shape, and specific gravity of the stones: for although the total weight of the charges may be pretty constant, yet the individual

* See observations on this bad effect of stone-mortars quoted from St. Paul, in art. 63.

stones, being very dissimilar in all these respects, will not range alike. It is for this reason that all the authorities we have quoted only use stone-mortars to fire upon the direct saps which are pushed forward upon the capitals of the salient and re-entering places of arms, and never perpendicularly at a single trench.

Having considered all this, there can remain no doubt that the use of what M. Carnot calls the different sorts of vertical fire, is recognised and strictly enforced by all the great masters, quite as far as it can be applied with advantage; and if it has fallen into comparative disuse in some cases, it has arisen from unavoidable deficiency in equipment, or is a deviation from rule, which M. Carnot might have pointed out without pretension to novelty; but this would not have answered his purpose.

CHAPTER II.

OBSERVATIONS ON THE GENERAL APPLICATION OF M. CARNOT'S PRINCIPLES OF DEFENCE TO NEW FORTRESSES, AND ON THE ALTERATIONS WHICH HE SUGGESTS FOR IMPROVING EXISTING PLACES.

§66. WHAT has already been advanced, to prove the *superiority* of vertical fire, and the fallacy of M. Carnot's plan for adopting it as a principal, instead of an *accessory*, may be applied further in judging the *defects* of the new system of fortification which he has brought forward, and of the alterations which he recommends should be made in existing places, in order to adapt them properly to his new mode of defence; for if the author has succeeded in showing that the *proposition* of M. Carnot for defending ordinary places is founded upon an erroneous estimation of the powers and uses of vertical fire, then the new works, and the *new fortifications* which he has arranged upon the

same principle, are doubly defective,—they cannot be successfully defended by the means he suggests, and are not purely susceptible of any other.

67. These main branches of M. Carnot's doctrine are so inseparably connected in principle with each other, that the author cannot avoid noticing the remaining heads of his theory, more particularly as his principles of construction, as well as modes of defence, are, in various degrees, gaining ground in quarters where we should not wish any doubtful, untried, or defective principles of defence to be resorted to. Professional discussions with foreign engineers have shown the author that M. Carnot has a great many disciples among them. It is not for us to desire that those who belong to nations most likely to be inimical to us, should turn apostates from the new doctrine which they profess; but, if there be error in it, we should endeavour to prevent its delusions from spreading in other quarters.

The principles upon which M. Carnot establishes his new system of fortification, are the same as those he assumes in that part of his treatise which has already been considered. They are recapitulated, in the part we are now to notice, in a long discourse, '*On the improvements of which the defensive art is susceptible by a more advantageous disposition of the parts of which the general systems of fortifications are composed.*'

68. In this discourse, M. Carnot proposes some very extraordinary abandonments (which it will be necessary to consider) of some fundamental principles of construction; but as it would probably be unsatisfactory to most readers to find themselves brought to the judgment of questions in principle, without reference to some test by which they may be tried, the author thinks it right to present them with a description and plan of M. Carnot's new system, which he will then proceed to attack. We may then reason with greater certainty upon the character of the new project, and consider, without much chance of falling into error, the effect of those abandonments, which M. Carnot has

proposed, of what have long been esteemed the main features of defensive strength.

"The spirit," says M. Carnot,^a "of this new system of fortification consists in procuring, by the particular combination of the parts which compose it, numerous debouches on all the avenues of the place, so that the besiegers may not be able to establish themselves near it without being exposed to be suddenly attacked, at all times, by the whole garrison. From these attacks the enemy will not be able to protect himself anywhere, without keeping troops constantly drawn out, ready to repulse any sortie the besieged may unexpectedly make, and which they may renew whenever they please. The besiegers will therefore be obliged to accumulate troops on all parts of the immense circumference which they must occupy, to embrace the defences of the place; and, as in the *défense rapprochée* all this development of force is within the influence of vertical fire, showers of projectiles will carry off some men every moment, and at length entirely crush the besiegers."

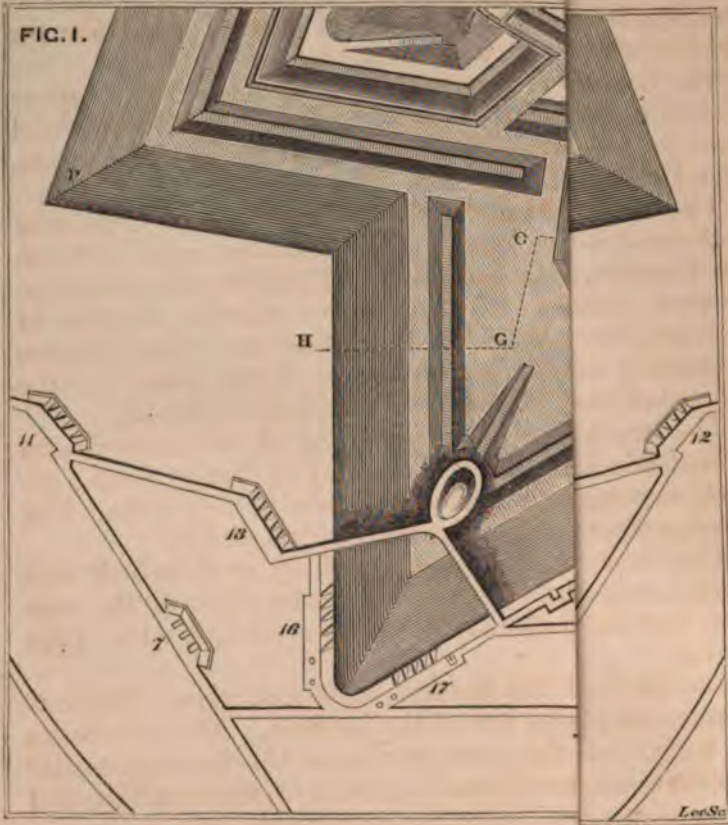
This "torrent of vertical fire" is thrown from case-mated mortar-batteries, the positions of which are determined from an acknowledged defect in Vauban's systems, viz., the deficiency of fire on the prolongations of the capitals of the bastions, but which fault M. Cormontaigne has remedied by constructing redoubts in the re-entering places of arms.

69. M. Carnot's ideas of the irresistible effect and exclusive advantage of this profusion of vertical fire in defence, are such, he asserts (p. 445), that it will change entirely the character of the operations of a siege. "According to the existing practice," he says, "the besiegers are covered and the besieged exposed. In the new system, on the contrary, the besieged are covered, but the besiegers exposed to a profusion of *feux verticaux*, which will reach them behind their parapets and lodgments, enabling the besieged to defend their outworks without occupying them, merely by

^a Page 422.



FIG. 1.



6
2
2
A
2



To face p. 53.

pouring upon them torrents of vertical fire when the assailants move forward to the attack."

70. Consistently with these principles, and in correction of those defects which he ascribes to all natures of the *ligne bastionnée*, M. Carnot arranges his new system. (See the adjoining plan.)

The casemated mortar-batteries are placed in interior enclosures in the gorges of the bastions, so as to fire in the direction of their capitals. There are nine casemates in each battery: of these, seven contain mortars or pierriers, two in each; the other two (the extreme casemates) are each armed with three guns, for the defence of the ditch of the *retranchement général*.

The scarp (see profiles, fig. 2,) of the *retranchement général* is a detached wall placed in front of the rampart, leaving a *chemin des rondes* 21 feet wide. The exterior slopes of the ramparts are all at 45°.

The bastions are also covered by a detached wall erected near the base of the exterior slope of the rampart, leaving a *chemin des rondes* six feet wide. (See fig. 3.)

The ditch of the bastion is 36 feet wide. Counterguards are placed before the bastions. The demilunes are works of the same profile as the counterguards.* The cavaliers are placed in front of the tenailles, and communicate with them by caponnières.

The counterguards and demilunes have ditches 36 feet wide at bottom, the counterslopes forming a reverse glacis 43 yards broad, which M. Carnot calls *glacis en contrepente*.

71. Having described, in detail, his new system, M. Carnot gives us "an analysis of the means of defence," to show the impossibility of reducing it.

In the attack which he has applied to his own system, M. Carnot must be excused for having advanced upon the strongest points, and for having adopted a plan of

* M. Carnot sometimes calls his counterguards and demilunes *glacis coupés*, and under this name recommends them for improving the defences of existing places.

operation much exposed to, and expressly calculated to show to advantage, the powers and principles of his means of defence. This he has undoubtedly done; but we must endeavour to arrange a plan of siege as different as possible from that he suggests, and try to defeat those advantages which his system might perhaps be found to possess, were it attacked in the manner he desires.

M. Carnot says (p. 485), "the enemy will probably advance, as usual, on the capitals of a demilune and two collateral bastions: an operation which the two great batteries of the gorge, firing constantly *à ricochet* on the capitals of the bastions, will render much more difficult than when opposed in the old manner.

"These difficulties will be considerably increased when the operation of crowning the glacis is attempted: for that operation will be seen, as usual, in flank, and commanded from the ramparts; whilst the besiegers will find themselves exposed to sorties which the garrison may make, either wholly or in part, by the glacis en contrepente.

"The scarps not being seen from the crest of the reversed glacis, a bastion cannot be breached without first taking the counterguard: a work defended by enfilade and reverse fire from the flanks of the adjoining bastions and cavaliers.

"The besiegers must therefore establish batteries on the crest of the glacis, to counterbatter the flanks of the bastions and cavaliers; and afterwards endeavour to make lodgments in the exterior slopes of the counterguards,—in attempting which a war of mines will ensue.

"Should the besiegers even succeed in making an opening in the face of the counterguard, and in breaching the scarp-wall of the bastion, it is easy to see that it will be impossible to assault it; for their columns would be attacked by sorties on both flanks at the same time, as well by the ditch between the wall and the counterguard, as by the *chemin des rondes* of the bastion. It would therefore be necessary to blow up the counter-

guard altogether, in order to see and destroy the wall of the bastion, before the assault is attempted; and all this is to be done under a constant shower of vertical fire, whilst the besiegers are assailed directly by columns from the gorge of the bastion, taken in flank by others from the ditches of the bastions and counterguards, and turned or cut off by great sorties issuing from the *glacis en contrepenste*.^a

72. But the besieger must endeavour not to fall so easily into these snares, nor expose himself to effects which, with a little circumspection, may in a great degree be avoided. In the first place, the besieger should direct the attack against *two* demilunes and *one* bastion, instead of presenting himself directly to the fire of two great *batteries de gorge*. The crowning of the *glacis en contrepenste* may be more effectually protected from sorties than the corresponding operation in the attack of existing places. The counterguards are not effectually defended by flank fire: they are usually flanked by the bastions, or demilunes; whereas in M. Carnot's system the cavalier, having the same command as the bastions, masks the fire of their flanks, and leaves the counterguards to be defended by flank-fire from the cavalier only. M. Carnot justifies this abandonment by observing,^b that the importance of flanking defence in ancient fortifications arose from circumstances which do not now exist: he farther observes that the advantage of this principle of defence has almost vanished since the invention of artillery; and that, to re-establish an equilibrium between attack and defence, it will be necessary to have recourse to some more efficacious means. We

^a M. Carnot relies upon the supposed impossibility of breaching the detached wall, because it cannot be seen from the country; and, in fact, this is the foundation of his new system of defence. The author feels confident, however, and experiment has proved that such confidence is well founded, that the wall may be breached by ricochet fire from the first or the second parallel, so that it would not be necessary to construct breaching batteries on the crest of the countersloping glacis. Assaults on the ramparts behind the detached wall might afterwards be made through the breaches thus formed by a distant fire; the sorties of the garrison being kept in check by troops posted for the purpose on the ruined counterguard.

^b Page 440.

shall see hereafter whether those means which M. Carnot *has* substituted are more efficacious than those he thus easily abandons.

73. With respect to *mines*, M. Carnot has not shown how he proposes to apply them : we can therefore only reply in general terms to the allusions which he has made to them. It is evident that any system of mines applied to M. Carnot's fortress would be too expensive to construct,^a and extremely inconvenient and difficult to use. Where would be the entrances of the galleries ? Not in the counterslopes : they must pass underneath the ditches (at a depth of at least twenty feet below the level of the country) from the body of the place to the further or upper part of the *glacis en contrepente*. If, in defending the counterslopes, "a war of mines" be resorted to in the manner he suggests, the most successful use that could be made of them (though immediately destructive perhaps of some of the besiegers) would ultimately prove extremely injurious to the defence of the place ; for it would effect that, as a defensive measure, which M. Carnot says is the most desirable, but at the same time the most difficult operation for the besiegers to accomplish, viz., blowing up the counterslope—a measure which would expose the bastion to be breached from the battery on the crest of the *glacis en contrepente*.

74. The casemated batteries (which at this stage of the siege M. Carnot proposes to arm entirely with pierriers) cannot participate at all with the troops in the actual defence of the counterslope or bastion. This will be very evident upon an inspection of figs. 2, 3, on plan opposite p. 53, which are sections on the lines AB, BC, CD, through the general retrenchment, the casemated battery, and the faces of the bastion and counterslope. The distance from the casemated battery to the salient of the counterslope is about 240 yards. Does M. Carnot imagine that he can pour "torrents of vertical fire," composed of stones, small balls, or grenades, upon

^a This M. Carnot admits. He says (p. 487), "Cependant comme cette galerie ne laisse pas d'être dispendieuse, je ne la conseillerais que sur les fronts d'attaque."

the besiegers' lodgments on the counterguards, or upon the ditch of the bastion, over the heads of his own troops posted on the rampart and behind the scarp-wall, without touching them? These torrents of projectiles would be widely scattered in every direction, and be more likely to fall upon the defenders than upon the assailants posted in such proximity. Suppose a charge of stones to be thrown from the casemated battery, at 45° of elevation, intended to play upon the besiegers lodged on the counterguard: the descent of the projectiles being nearly parallel to the exterior slopes of the ramparts, all the stones which pass within eighteen or twenty feet, over the crest of that slope, would strike the back of the wall; but the greatest part of the charge would fall upon the rampart and in the interior of the bastion. Neither the scarp-wall, therefore, nor the parapet, could be manned with safety, whilst the casemated batteries are in activity; and if not manned, what should hinder the bastion from being taken by assault as soon as the flank-fire from the cavaliers is sufficiently subdued?—Vertical fire with stones, small balls, and grenades! The reverse application would be much more destructive; for M. Carnot's principle of active defence by incessant sorties, and the open, exposed, accessible nature of defences, contrived principally for facility of egress, would require continual assemblages and movements of troops in works where there are few sheltering obstacles; no covered way; no traverses; no counterscarp-wall; none of those abrupt inequalities and recesses which are found to protect troops from the destructive effects of ricochet. Bodies of troops constantly posted in such defences would be more a prey to the ravages of ricochet, and all sorts of vertical fire, than the besiegers. These, lodged closely in small spaces, and chiefly in trenches transverse to the lines of fire, would suffer much less from projectiles which scatter most in a longitudinal direction than the besieged—dispersed without cover throughout the whole interior of the work, posted on the ramparts, circulating in the ditches, chemins des rondes, and communications. The dispersion of a charge of stones,

thrown from a mortar or pierrier, is very much greater than any person who has not witnessed their effect would imagine. No two stones of the same charge fall within many feet of each other; and the dispersion is very much greater in a longitudinal than in a transverse direction, for the reasons given below. This is also the case, though in a less degree, with projectiles of the same size, shape, and specific gravity: as, for instance, a charge composed of iron balls; for the dispersion commences from the mouth of the mortar, and forms what is called the *cone of spread*. Now as the horizontal plane receives the action of the cone of spread obliquely, the area in which the balls take effect must be somewhat elliptical, and the dispersion greatest consequently in a longitudinal direction. But, lest all this should be received as matter of opinion, instead of fact established by experience, the author gives the results of some very careful experiments, made purposely to ascertain the precise effects of those natures of vertical fire which M. Carnot proposes to adopt as the principal means of defence.

75. The following experiments were made with different charges of stones from a 10-inch iron mortar. Elevation 45° :—

1st.—*Charge* 10 oz. of powder, and 50 flint-stones, each about 14 oz. The average range was 107 yards; but most of the stones were blown to pieces.

2nd.—*Charge* 12 oz. of powder, and 40 stones of hard granite of about 1 lb. each. The nearest stones fell at 40, and the furthest at 120 yards: the transverse spread was 30 yards.

3rd.—*Charge* 16 oz. of powder, and 46 stones, as before. The nearest stones fell at 50, and the furthest at 130 yards from the mortar: the spread was 45 yards. One stone went off to the right in an angle of about 45° , and fell at the distance of 100 yards in that direction, very near a spectator placed, as he thought, in perfect safety.

76. The following experiments were made with a brass pierrier. Diameter 16 inches. Elevation 45° :—

1st.—*Charge* $2\frac{1}{2}$ lbs. of powder (which filled the chamber), and 100 granite-stones of 1 lb. each, piled up to the mouth of the pierrier in a basket with a bottom of wood. The nearest effect was 28 yards; the furthest 300: the spread was 70 yards. Many of the stones broke.

2nd.—*Charge* $1\frac{1}{2}$ lb. of powder, and 75 granite stones of $1\frac{1}{2}$ lb. each. The nearest effect was 12 yards, and the furthest 180: the spread was 50 yards.

In both cases it could not well be ascertained where the greatest effect was, on account of the great dispersion of the stones—many of which broke even with the reduced charge.

77. Applying these experiments to the plan and profiles, opposite p. 53, we perceive that the nearest effect would take place in the gorge of the bastion, at O, fig. 1, and O, in the profile, fig. 2; and that the furthest effect, at P, fig. 1, would not reach the crest of the glacis, even with the full charge of powder. It appears, therefore, that neither the third parallel, nor the crowning of the glacis, are within the reach of stones, forced to the utmost from pierriers in the casemated battery; and the horizontal area of all those parts of the attack which come within its influence is so small, compared with the vast magnitude of the oval surface upon which the stones fall, that, it may be relied upon, not one stone in one thousand would take effect upon the besiegers.

78. A substitution of large balls and grenades, fired from mortars, would be less uncertain and more formidable; but, even with these, the dispersion is very great. One hundred iron balls, of 1 lb. each, were discharged from a 10-inch iron mortar at 45° elevation, with a charge of 1 lb. 4 oz. of powder. The spread was 50 yards; the nearest effect 150, and the furthest 210 yards: the longitudinal dispersion was therefore 60 yards, and consequently the area of the surface affected by the descent of the balls, supposing it to be an ellipse whose axes are 60 and 50 yards, was 20,476 square feet. The chances of hitting would therefore be very remote,

whilst the expenditure of iron would be immense. At the rate of discharge which M. Carnot mentions (p. 231), it would require a provision of nearly one million and a half pounds of iron for the seven casemates of a battery at the gorge of a detached bastion.

79. We may now proceed to apply the proposed plan of attack with perfect confidence that vertical fire will not contribute so effectually as M. Carnot imagines to the *défense rapprochée*.

The ordnance required for the attack, shown in the plan opposite p. 53, is as follows:—(*The batteries of attack, up to the third parallel, are not shown in the plate.*)

No. of Battery.	Guns.	Mortars.	Howitzers.	Pierriers.
1	7	2	..	..
2	4	2	..	..
3	4	2	..	..
4	7	2	..	..
5	10	4	..	..
6	10	4	..	..
7	..	..	3	..
8	..	..	3	..
9	..	..	7	3
10	..	..	7	3
11	4	..	..	..
12	4	..	..	..
13	5	..	..	..
14	5	..	..	..
15	..	8	..	4
	60	24	20	10
16	5	Brought forward from the other batteries.		2
17	5			2
18	5			2
19	5			2
20	5			2
21	5			2
22	5			
	35			

This proportion of ordnance is about the same as that usually estimated for the attack of a front of Vauban's first system, calculated at the lowest rate.

70. The attack (plan opposite p. 53) is made upon a bastion and its collateral demilunes.

The first parallel is traced, as usual, about 600 yards from the most advanced points of defence, and extended sufficiently to embrace the prolongations of all the works which have influence on the attack.

The inward faces of the adjoining bastions, and their counterguards, are ricoched by the batteries at the extremities of the parallel; and batteries are established to ricochet the inward faces of the two demilunes and their ditches.

At the same time that these batteries are being constructed, approaches are pushed forward on the three capitals; and the second parallel commenced as soon as the ricochet batteries are in activity, which should be in thirty-six hours after their commencement.

M. Carnot despises so completely all the early operations of attack,* that we may presume upon being very little opposed in constructing these works; and consequently that they may easily be finished in the usual manner and time. The barbet batteries in the salients of the demilunes would soon be destroyed and the guns dismounted, if not removed, upon the completion of the batteries by which the inward faces of the demilunes are ricoched. The faces of the two collateral bastions and their counterguards would also be ravaged and swept by the other batteries; and, if necessary, batteries might also be formed in the first parallel to ricochet the faces of the bastion attacked, and its counterguard: but the importance of throwing a more powerful fire upon these works should, the author thinks, induce us to reserve these batteries for positions in the second parallel, satisfied that they may be constructed without establishing more ricochet batteries in the first place of arms. One battery may, however, be constructed; and should be armed with heavy mortars and howitzers, to fire, at low elevations, in order to ruin the circular portion of the scarp-wall opposite to the casemated battery of the gorge, and to injure or break in the casemates. If 8-inch mortars

* See art. 35 above.

are placed in this battery, they should use, occasionally, 68-lb. shot, or shells filled with lead; but heavy iron howitzers or carronades will do better. There can be no doubt that with such means the scarp-wall and casemates would sustain very considerable injury.

81. As soon as the second parallel is completed, batteries are established to ricochet the faces, chemins des rondes, ditch, and counterguard of the bastion attacked; and the outward faces of the adjoining demilunes with their ditches. The ends of the parallel are secured by redoubts, armed with field-artillery.

When these batteries are in activity, the demi-places-d'armes are commenced: they are run out from the flank branches of those batteries, until the prolongations of the inward faces of the demilunes are intercepted, and there howitzer batteries are constructed.

The batteries made in the second parallel to ricochet the faces of the bastion attacked will be so effectual in ruining their defences, that it does not appear necessary to construct half-parallels and howitzer batteries against them, as has been done against the faces of the demilunes.

The zigzags upon the capital of the bastion are pushed forward, from the second parallel, simultaneously with the construction of the half-parallels; and as soon as the batteries formed in them are in activity, the third parallel is commenced. It is traced in a right line nearly, joining the three salients of the glacis en contre-pente.

The half-parallels are now extended outwards so as to embrace the prolongations of the flanks of the adjoining bastions, and other batteries are there constructed. The extremities of the half-parallels are connected with the second parallel by trenches or places of arms, which are thus flanked by the adjoining faces of the redoubts, and protect the batteries in the half-parallels from being turned by sorties. At the same time that this is doing, the howitzer batteries 9 and 10 are established in the third parallel, to ricochet the faces of the bastion attacked, its ditch and counter-

guard, if no half-parallel and howitzer batteries have been already constructed for these purposes.

The objects of the mortar-howitzer battery (No. 15) are, to endeavour to ruin as much as possible the scarp-wall of the bastion, and the casemated batteries; also to ricochet and shell the communications, chemins des rondes, and the general retrenchment.

An attentive inspection of the plan opposite p. 53, will show that the besieged must suffer greatly from this battery, particularly at that advanced period of the siege, which will oblige them to keep their defences manned: for the entrances to the chemins des rondes of the bastion being in its gorge, at the base of the interior slope, the troops entering and returning will be continually passing close to the back-wall of the detached casemates which flank the ditch, in directions parallel to the capital of the work, and consequently exposed to ricochet fire from battery No. 15; and the ramp leading to the interior of the bastion, being constructed exactly upon its capital, will be much ravaged by the continual ricochets fired in that direction. The seven casemates à *pierriers* being open at the ends, all well directed shot or shells which do not pass more than fifteen feet over the top of the scarp-wall, will either enter a casemate, or, striking the piers or the ends of the arches, knock off splinters of stones, which cannot fail to commit great destruction among the troops lining the wall immediately in front.

Nor will the battery itself remain in a perfect state to this period of the siege. It is not too much to expect that eight heavy mortars, or howitzers, in action since the opening of the batteries, will have done very material damage to, if not breached, the scarp-wall by which the ends of the casemates are covered; and it is evident that, wherever a breach or fracture is made in it, the interior of the adjoining casemate will be completely exposed to direct fire, whenever a lodgment on the salient of the bastion is established: and it should be remarked that the scarp-wall is only four feet six inches thick, in the recesses made for receiving troops.

82. As soon as the third parallel is finished, lodgments should be made on the crest of the glacis by saps branching outwards from the three capitals, in circular directions round the salients, and thence parallel to the edge of the glacis; constructing traverses and parados wherever it may be necessary to defilade the interior of the trenches from any of the works of the place.

Double saps are pushed forward at the same time from the third parallel, and an advanced parallel worked right and left to join the lodgments, or the crowning battery, of the glacis.

At the same time that these works are commenced, trenches are worked from the half-parallels, to obtain prolongations upon which to construct the batteries 13 and 14, which have very important objects to accomplish, viz., to ricochet the faces of the cavaliers and the general retrenchment. It appears, by measurement and calculation, obtained from the difference of command of the cavalier and demilune, together with the distance between their sections on the line of this prolongation, that the cavalier may be seen at the point marked by the right of battery No. 13;^a and terms taken from the respective commands and distances of the retrenchment and other works on the line of its prolongation show that it may be seen at the places marked for batteries 13 and 14, and consequently that it may be ricoched in both directions. The prolongations of the retrenchment are obtained, as Plate I. will show, clear of the cavaliers; for the command of these works is such as to cover batteries 13 and 14 from all the intercepted portions of the retrenchment. It is only, therefore, at the parts most remote from the bastion attacked that these batteries can be seen, and that very obliquely:—they cannot be counterbattered. Thus the portion of the retrench-

^a M. Carnot asserts that the cavalier cannot be ricoched, because it is covered by the demilune. But this is incorrect: for the prolongation of the long branch of the cavalier cuts the demilune at a less distance than from that point of intersection to battery 13; and, as the demilune has only half as much command as the cavalier, the latter is quite sufficiently exposed to be ricoched from battery 13.

ment from which battery 13 may be seen, would be ravaged by the alternate ricochet battery 14; and the part affecting it be ricoched by battery 13: the *fausse-braye*, or curtain, is not made to receive artillery. The apparent exposure of batteries 13 and 14 to several stages of fire renders it necessary to notice these circumstances, in order to meet here any observation that might occur as to a difficulty in constructing and using these batteries. The nature of the polygon affects some of these circumstances, and would require some modification in the plan of attack; but we must confine our reasoning to the case before us. The batteries 13 and 14 are connected, by trenches, with the crowning battery of the glacis, and armed with five 24-pounders each.

The trenches, saps, and parallels, should be defiladed from the fire of the place, by making their *terre-pleins* parallel to the plane in which the crests of the enemy's works and the besiegers' trenches lie, so that the lines of direct fire, passing close over the parapets of the trenches, parallel to the plane of their interior spaces, do not command them any more than if both were in the same horizontal plane. This only requires the additional labour of taking out the prism of earth necessary to slope the bottom of the trench in a plane parallel to that of the command, (which, in the present case, is very trifling,) and to make the parapets of the batteries a little higher than usual. If this be carefully executed, it will effectually cancel the advantages which M. Carnot dwells so much upon, as arising from this effect of command.

83. We now come to that part of the operation at which M. Carnot says the besiegers will find themselves exposed to the full effect of sorties.

Before we proceed to examine whether sorties, made from such a place, properly attacked, would be more likely to be attended with success and advantage, than those made from any of the existing systems, it may be proper to revert to the general principles and maxims that have been established upon very mature experience,

sions." Similar opinions may be traced in every work of character that has been written upon this subject, from the date of the authorities just mentioned to the admirable record of our practice, which, together with corrective observations for future guidance, Colonel Sir John Jones has given in his '*Journal of Sieges*.' If the example set by the publication of that work be followed by officers who may be charged with similar duties hereafter, we may reasonably hope that the British service will not always remain dependent on foreign works or systems for its guidance.

85. Now if it appear that the attack marked upon the plan, opposite p. 53, be as well supported and covered by places of arms, as little exposed to be taken in flank—in short, as capable of opposing and defeating sorties as that disposition of parallels, trenches, &c., upon which the opinions and maxims just mentioned have been formed, will afford,—then it will only remain for us to consider, whether the facilities which M. Carnot has contrived for bringing out his troops should overturn what has been so generally experienced, and taught, as to the ordinary failure and disadvantageous results of such enterprises: the question resolves itself into this,—Whether the expediency of making sorties depends upon the mere convenience, or facility, of bringing out the troops; or, with whatever ease they may get out, upon the defensive measures and force opposed to them;—the prospects of success;—the consequences of failure;—the loss likely to be sustained;—and upon the circumstances of the garrison as to being strong enough, in force, to afford that loss, and good enough, in quality, to resist the moral effects of a defeat, which M. Vauban justly observes is so hurtful to the spirit of the garrison.—If these be the governing considerations which should determine the propriety of undertaking sorties, then the accessibility of all M. Carnot's outworks, and consequently their exposure to be assaulted when weakly garrisoned, is a sacrifice made to that on which the issue does not essentially depend, and one that would oblige the besieged to keep bodies of troops continually posted

in exposed works, where they would suffer dreadfully from the very nature of fire which M. Carnot had intended only to inflict on the besiegers.

86. When a garrison is so numerous, or when the besieging force is so inadequate to the enterprise, as to justify the measure of making sorties in force, there is no difficulty in filing out troops for this purpose through the numerous debouches provided in an ordinary covered way. If a sortie is to be made against the second parallel, the troops and workmen composing the main body, move out in eight columns, (immediately afterwards formed into four,) from eight different outlets in the four re-entering places of arms, each passage admitting easily of four men a-breast, and consequently of the transit of 320 men per minute, if moving at the rate of eighty paces of thirty inches each in that time. Two flanking parties, to cover the operation, move out, each in two columns, from the passages in the more remote places of arms of the adjoining fronts. These debouches altogether admit of filing out, and forming in line at the foot of the glacis, a body of 2560 men, exclusive of the flanking parties, in about seven minutes; and the time required for this operation may be shortened by placing a number of step-ladders to mount over the palisades in the three salient places of arms of the front attacked. If a sortie is to be made against the third parallel, eight or ten step-ladders should be placed in each of the three salient places of arms, and the eight communications from the four re-entering places of arms used besides.

87. Surely then it does not appear that there is any such difficulty in filing out troops for sorties from existing places, as should induce us on this account to abandon obstacles which are absolutely necessary to prevent the besiegers from easily getting in. The new system of glacis coupés may be calculated to admit some brilliant, though generally rash exploits, from a place provided with a very numerous garrison, or attacked with insufficient means; but it will prove most alarmingly defective when the places to which such works

may be added, come to fulfil the true purpose for which fortifications are erected—to enable a small force to oppose seven or eight times its number. When this occurs, the very facilities of egress, which under such circumstances the besieged cannot use, will give facility of ingress which the besiegers will not fail to avail themselves of; and it appears that the purely defensive qualities of these works are so defective, that a small garrison, capable enough of defending for a time ordinary works of equal development, would be insecure in this; and that a weak garrison would be utterly incapable of defending such a place at all: and perhaps these works are more defective in a partial application to old systems, than in a general adoption to the whole scheme of defence.

88. M. Carnot is so well aware of the impossibility of defending his glacis coupés *de pied-ferme*, and of using vertical fire at the same time, that he says,* “these works should not be occupied, lest the enemy should take them by assault, and getting mixed with the troops posted in them, take prisoners in the *mêlée*, and prevent the besieged from firing upon the assailants.” M. Carnot here again asserts the efficacy of vertical fire, to answer this obvious inference—that, if the counterguard is not occupied, the besiegers may easily carry it by assault, and establish themselves upon it. He says that it cannot be occupied, on account, chiefly, of the danger from vertical fire: but the author has shown that, if he resorts to this mode of defence, he cannot occupy the scarp-wall or salient of the bastion either; and if so, the besiegers may not only take the counterguard, but proceed, without loss of time, to the attack of the bastion.

89. Is it necessary to do more, at present, upon the subject of sorties, than to refer the reader to the Plan? All the works—all the exterior debouches and ditches from which sorties can proceed—are, at this state of the siege, under all sorts of fire. The passages between the

* Page 480.

ends of the demilunes and the faces of the counter-guards are enfiladed and flanked from the different lodgments on the salients of the glacis. The flanks of the attack are well secured against sorties from the adjoining fronts. The second parallel is supported by redoubts, and covered from being turned, by being out-flanked by the first place of arms. The third parallel is connected with the second by trenches of defence, or places of arms, flanked by the adjoining faces of the redoubts. The crowning of the glacis is also covered in flank by the places of arms near the battery 13 at one extremity, and 14 at the other; and there is absolutely nothing in the proposed attack, bearing upon the question of making sorties, that should overturn the general principles already established by long experience as the governing considerations which should be consulted, and which it has been shown are not at all connected with any principles of construction.

90. When the crowning of the glacis is completed, and the counterbatteries established, the position of the besiegers would be found still more capable of defeating and punishing the sorties; for the counterslope forms a good old-fashioned glacis to the besiegers' trenches on its crest, and gives the enemy all the advantages of a covered way and glacis *opposed* to the place;—advantages surrendered to them for a very defective, and, in some cases, dangerous substitution, which saves the great difficulties and labour attending the descent into the ditch, and enables the besiegers to cover the passage of it by batteries placed on the crest of (to them) a *glacis proper*.

91. M. Carnot mentions repeatedly the defence of Grave, in 1674, as a brilliant instance of protracted defence arising entirely from the effects of continual sorties; and supports his opinion of the advantages of a glacis en contrepente by stating,* that “the chief cause which contributed to the success of those enterprises of active defence which took place at Grave, was, precisely, that the place had neither counterscarp revet-

* Page 457.

ment, traverses nor other obstacles in the covered way;" and consequently that sorties were made with great facility. It is proper therefore that we should look narrowly into the circumstances attending this siege, to see how far they confirm the theory which M. Carnot has endeavoured to establish upon it.

92. M. Rabenhaupt was detached by the Prince of Orange, with about 11,000 men, to besiege Grave, in which there was a garrison of 4000 men, commanded by M. Chamilly, an officer already distinguished by his conduct at Candia and in Portugal.

The investing force required to attack a place such as Grave, containing a garrison of 4000 men, should not be under 21,000 men at the very least. This is the very lowest calculation that can be made, consistently with the number of troops required to furnish working parties, guard the trenches, and provide for camp and line duties.

The force required for guarding the trenches should not be less than three-fourths of the strength of the garrison; and, unless this be observed, the works of attack will be continually exposed to interruption, and perhaps to destruction, by sorties. Now, what sufficient appropriation of force to these several duties could M. Rabenhaupt have made with 11,000 men? The proportion required for line, camp, and other duties, is generally rated at, and cannot well be under, one-tenth of the whole.

	Men.
This, taken at three reliefs, is	3300
Working parties, at least 1200 men, taken at three reliefs, is	3600
	<u>6900</u>
Which taken from	11,000
leaves, for guarding the trenches, &c. . . .	4100

This, taken at three reliefs, only furnishes 1366 men to oppose sorties which, no doubt, were made with 3000 men; and in the above calculation no allowance is made for sickness or casualties, and all the duty is taken

at three reliefs, which no troops could stand but for a very short service, and in very fine weather.

It appears, therefore, that M. Rabenhaupt attacked the place with means so insufficient as necessarily to expose himself to all that occurred, even had he been opposed to a less enterprising officer. This, indeed, is admitted as the cause of the protracted defence, by the very historian who celebrates the event. M. Quincy, in his 'Histoire Militaire de Louis XIV.,' vol. i., p. 387, says, that "from the frequency of the sorties it was difficult to pronounce whether M. Rabenhaupt was the assailant or the defender; which showed the General the error he had committed in having flattered himself that he could reduce the place with the small force which had been given him."

93. M. Carnot is in error in stating that there were no traverses in the covered way, nor any other exterior obstacles at Grave. The 'Histoire du Corps Impérial du Génie' informs us (p. 114) "that M. de Chamilly, certain of being attacked, had perfected all the works—thickened and reveted the parapets, made bomb-proof magazines under the ramparts, *placed a double row of palisades, barriers, and traverses, in the covered way,*" and that he opposed all sorts of exterior obstacles to the "cheminemens de l'ennemi." This differs very materially from M. Carnot's account. It shows that the usual defensive obstacles of a regular covered way do not prevent active defence by sorties, when circumstances of relative force, and other considerations, justify their being undertaken; and so far are the real circumstances of this siege from holding it up as a splendid example to show, generally, the vast advantages, and enforce the propriety, of making continual sorties, it appears that the attack was a very condemnable attempt with a force that could not hold out any fair prospect of success. It is well known that when the Prince of Orange was obliged to raise the siege of Oudenarde, he marched to Grave with the Dutch contingent, and that M. Chamilly's garrison had been so much reduced in the sorties it had made, that the place soon sur-

rendered, although its defences were not much injured. The terms granted to the garrison were such as were due to brave men who had done their duty in chastising, with vigour and spirit, a rash attempt made upon their fortress, but who surrendered to a force which made any further resistance vain and hopeless.

94. We now proceed with the attack. Batteries 17 and 18 are constructed to counterbatter the faces of the collateral bastions; 16 and 19, against the faces of the bastion attacked: batteries 20 and 21 counterbatter the acting faces of the cavaliers, which, it must be recollected, have already been ricoched by batteries 13 and 14.

Without ascribing any superior degree of efficacy to the fire of the batteries by which the faces of the demilunes will have been ricoched, there can be no doubt that they may easily be taken by assault. We have, indeed, the admission of M. Carnot for asserting that troops occupying them would suffer so dreadfully as to be incapable of defending them. He admits, expressly (p. 492), "that the demilunes are so much exposed to stones and ricochets, that troops cannot remain in them." The form given to the cavaliers, for the purpose of strengthening their salients, shows that they are designed to prevent lodgments from being established on the demilunes; but the batteries 13 and 14 counterbatter these salients, whilst 20 and 21 take them in flank and in reverse; and as the command of the cavalier prevents the salients of the demilunes from being seen from the intercepted parts of the retrenchment and *fausse-braie*, we may assert that the besiegers will not experience much difficulty in establishing themselves on the salients of the demilunes, as shown in Plate I.

These lodgments should not be much extended at present: it will be sufficient to occupy the salient of the rampart with a good solid lodgment, commanding the interior of the work; and particularly observing the spaces between the ends of the counterguards and the faces of the cavaliers, by which only the troops for the *retours offensifs* can come forth.

95. It will now be necessary for the besieged to show which mode of defence he means to adopt for the counterguards and bastions;—whether he intends to defend them *de pied ferme*, or by vertical fire—both he cannot use. If he prefer the latter, the besiegers should assault the counterguard, and form a lodgment on it, as soon as the trenches and epaulements are made across the ditch. These trenches should be occupied as places of arms to oppose sorties.*

A mine will then be made in the salient of the counterguard. If it be countermined, as M. Carnot suggests, then “a war of mines” will ensue; but the result will be, that the salient of the work will be demolished by one, or other, or both parties; and thus the main obstacle removed which M. Carnot admits (p. 480), “is so indispensable to cover the scarp-wall of the bastion.” If a war of mines should not be resorted to, the besiegers should drive a gallery perpendicularly through one of the faces of the counterguard, on a level with the ditch, as soon as a lodgment is made on the crest of the work. The labour attending this operation is much less than in making the usual galleries of descent into a ditch. The length of a gallery through M. Carnot’s counterguard is about twenty yards. The galleries of descent into the ditch of an ordinary place are about thirty-six yards each.

When the counterbatteries and epaulements in the ditches are finished, the position of the besiegers on the crest of the glacis en contrepente would be so formidable, that the author does not see how it is possible for the besieged to make sorties. The only debouches from which they can issue to attack, directly, the works of the besiegers, are exposed to two double tiers of enfilade and flank fire: for batteries 20 and 21 look directly into the spaces between the ends of the demilunes and the faces of the counterguard; and the countersloped glacis enables these batteries to fire

* The progress of the attack is not marked on the Plan, further than the occupation of the counterguard and the passage of the ditch, not to deface the fortifications.

over the epaulements in the ditch, and to combine their fire with that of the troops lodged in these works—for a shot fired from battery 20 to the bottom of the exterior slope of the cavalier, passes eight feet over the crest of the epaulement. A sortie issuing from either of these debouches would also be exposed to batteries 16 or 19, and to the epaulements in front of them, as soon as the enemy's troops appear; so that no sortie can come forth from these debouches without being exposed to a quadruple line of fire, under a continuation of which they would then have a very formidable line of connected places of arms to attack.

The debouches from the other sides of the demilunes are under fire of the batteries 17 and 18, and the corresponding epaulements respectively; and the position of the besiegers opposite to these outlets is no less formidable than the other.

96. It appears, therefore, that a glacis en contrepente, or glacis coupé, which M. Carnot has contrived for facility in making sorties, gives the besiegers, lodged on its crest, such decisive advantages for repelling them, that it is impossible they should be made from the fronts attacked; and the flanks of the attack are so well secured, that any attempt to make sorties from the adjoining fronts would be equally desperate and disastrous.

From the counterguard the besiegers proceed into the ditch of the bastion, in which strong epaulements are constructed to cover the passage, and to oppose sorties from the opposite debouche. If the salient of the counterguard has been destroyed, or even much lowered, the salient of the scarp-wall may be wholly or partially breached by the battery 22. If the counterguard be entire, the salient of the scarp-wall will be destroyed by a mine. M. Carnot asserts, that, should the besiegers even succeed in opening the counterguard and in breaching the scarp-wall, it would nevertheless be impossible for them to assault the bastion; because the columns of attack would be taken on both flanks by sorties from the ditch of the bastion, and by the *chemin des rondes*—

they would also be turned and cut off by great sorties issuing from the *glacis en contrepente*. But it is evident that, whenever the salient of the scarp-wall is breached, both branches of the *chemin-des-rondes* may be enfiladed from the lodgments on the counterguard; or, if only a few feet of the top of the wall were knocked down, that the remote ends of the *chemin-des-rondes* would be so much exposed as to prevent the besieged from reoccupying them, when, ceasing their vertical fire, they send forth their "*corps d'élite*," as M. Carnot states, to chase away the *débris* of the assailant's columns. It may indeed reasonably be expected that when the lodgments on the counterguards are formed, the scarp-wall will be found in a state of ruin, or to have received very material injury from the *ricochet* batteries; and the *chemin-des-rondes* be much encumbered, and perhaps rendered impassable in many places, by fragments of masonry, and rubbish from the slopes of the work, which the *ricochet* fire will have beaten off, and rolled down into the hollow space. With respect to the sorties to be made in the main ditch, "to take the columns of assault on both flanks," the attack has provided against such enterprises, by lodgments and epaulements which oppose them with double tiers of fire, and against which the troops would have to advance in narrow columns, presenting their alignements to these batteries. As to the large sorties issuing from the *glacis en contrepente*, to turn or cut off the assailants, M. Carnot must have aimed this observation at such assaults as might be imprudently made before a complete lodgment should be established on the crest of the covered way; and to have fancied, throughout, that his system would be attacked in the same spirit of rash bravery and "brute force,"—disregard of science and human life, as that in which the defensive scheme has been conceived.

97. The very serious defects arising from the sacrifice which M. Carnot has made of flank defence, to the imaginary superiority of vertical fire, may now be more distinctly exposed. The ditch of the bastion,

in which is passing that critical operation which must soon prove decisive of the fate of the place, is almost entirely unseen from any flanking branch. The cavaliers, were they even untouched by ricochet fire, could not effectually oppose the passage of the ditch: for the epaulements are only seen from a small part of these works; and the caponnière is not a work of defence, and cannot be used as such. Producing the interior lines of the counterslopes of the counterscudars till they meet the flanks of the adjoining bastions, we perceive that they have no influence whatever on the ditches of the collateral bastions. It is clear therefore that the passage of the ditch is scarcely seen at all, and cannot be opposed by any other nature of fire than vertical fire. It is not asserted that this will do no execution: but how far it is capable of preventing the operation, or of being considered an efficient substitute for direct flanking fire, is left to the judgment of the reader, on the practical evidence already before him; with this remark,—that if the effect of vertical fire should prove so harassing or destructive as to demand any sheltering expedients, *blindages* may be used to cover the passage of the ditch and any other very exposed part of the attack.

98. A lodgment should now be made on the salient of the bastion, either by assault, or by sapping up the exterior slope. Battery 15 will cover this operation by throwing shells into the interior of the work; and the howitzer batteries will precipitate it, first by a heavy fire on the salient and faces of the bastion; and, during the assault, by throwing shells into the interior of the bastion and upon the battery on the circular portion of the general retrenchment. According to M. Carnot's doctrine, the actual assault of the breach will be opposed by vertical fire: so long therefore as the battery at the gorge continues to throw vertical fire, the assailants are safe from "*coups de main*;" for no part of the interior of the bastion can then be occupied by the besieged. When the fire ceases, they may be expected. This is what M. Carnot calls reversing the character of

all the circumspection and caution that would be necessary against a place provided with a very numerous garrison, and the fullest means; but it is submitted to the experienced reader, whether, even against a place abundantly stored and garrisoned, the proposed mode of attack does not favour the side of defence, by proceeding in a more gradual manner than the spirit of M. Carnot's principles of defence would require, particularly in the first operations. The reader may also judge whether the confident forbearance which he enforces until the establishment of the third parallel be undertaken, does not allow us to infer, that the attack may proceed much more rapidly than has been stated; that such means and principles of defence would so wear and waste a garrison as to warrant us in throwing out from the scale of attack, much of that time and circumspection which have been employed; that the general retrenchment is no more than a refuge to manage a capitulation; and, finally, that such a work is very inferior to those retrenchments which may be made in the interior of an ordinary bastion.

100. It is not necessary to enter, at large, on the means M. Carnot proposes for improving the defences of existing places; for the main features of the alterations he recommends have already been considered with the new system of which they also form parts. But as these principles of construction are more likely to be adopted partially in restoring old defences, than wholly in raising new works, it is necessary to explain the nature of these alterations, for the purpose of bringing them under those observations which have already been made on the defects of the corresponding novelties in the new system.

M. Carnot proposes to convert a portion of each bastion into a counterguard, by making a ditch, about thirty-six feet wide, across the bastion, from the middle of each flank, in the directions of lines of defence; the two branches of the ditch meeting, consequently, on the capital. The part thus inclosed is formed into a

bastion, by making parapets upon the interior lines of the ditch, which thus become the faces of a bastion so small that its flanks are but sixty feet long—sufficient only to receive three guns. The new ditch is consequently very little defended by flank-fire; but this, consistently with the principles already noticed, M. Carnot has here also sacrificed to the imaginary superiority of vertical fire.

For the purpose, chiefly, of being able to make sorties with facility, M. Carnot proposes to convert the glacis into a *glacis en contrepente*, and, with the earth furnished by the excavation, to form the upper part of the old glacis into a counterscarp or *glacis coupé*, raised nearly as high as the body of the place. The interior slope of the new work occupies the greater part of the old covered way. The traverses are removed; and, instead of palisades, a brick wall, furnished with loop-holes, is constructed very near the counterscarp. The exterior slope of the *glacis coupé* is so abrupt that no part of it can be seen from the body of the place; and the greater part of the advanced ditch formed by this alteration cannot be seen at all.

101. All that has been said, to show the defects of such outworks attached to the new system, bears, with perhaps greater force, upon the bad effects of applying them to existing places. Such profiles are only applicable to Intrenched Camps and Positions; and, like them, demand, *absolutely*, the constant presence of large bodies of troops. The ditch formed by a *glacis en contrepente*; or the abrupt exterior slope of a *glacis coupé*; or any modification of such outworks as M. Carnot proposes, would afford great shelter to the besiegers. They are, in effect and position, species of parallels, upon which the besiegers may lodge themselves without difficulty. Their exterior slopes are covered from direct fire; flanking defence has been almost entirely abandoned, and vertical fire is ineffectual. The defence, therefore, must depend solely upon the personal exertions of a very numerous garrison. Ample proofs of inefficiency in the means, and of fallacy in the reasoning,

are already before the reader ; and he is entreated to refer to them again, if any doubt remain in his mind of the prejudicial tendency of any adoption whatever of M. Carnot's scheme of defence.

102. The great object—the true merit, and defined aim of fortification—is, to enable the weak to defend themselves, as effectually as possible, with the least possible means ; whereas M. Carnot's ingenuity has contrived systems, and alterations of systems, and outworks, which indispensably require large garrisons, and cannot be effectually defended by weak ones. But the times in which he wrote, and the power and policy of the master he served, may have demanded such profuse requisitions, and waste of human life and manly powers, and such a total departure from the economy of defence. Ordinary fortresses, provided with the usual garrisons, lost all value in the vast scale of operations which arose out of the peculiar circumstances of the late war. Immense armies passed, without precaution, places comparatively insignificant, containing garrisons too weak to attempt any offensive operation, although sufficient to discharge, fully, their defensive trust. To operate thus, regardless of fortified places, demands a very large force.—This Napoleon the First had ; and when M. Carnot was commanded to arrange a defensive system suited to the times, and to the circumstances of extended dominion depending on military occupation, he saw that the vast power which had been able to command means to act thus, offensively, should be employed to prevent such a plan from succeeding, if used against him, by raising the consideration of his fortresses in offensive power ; and thus converting them into *species of Intrenched Camps*, capable of containing, and easily sending forth, large corps of troops. This was the original object of M. Carnot's new system of defence ; but, even should the like circumstances again occur, the real economy of defence must be studied from other sources. Any application of his system, whether to old or to new places, must either be insecure or expensive : insecure, if not

provided with numerous garrisons; ruinously expensive, if they are. M. Carnot asserts that places constructed, or altered, according to his new system, are defensible with less means than other places; but the most expensive means that can be used, though he excludes them from his calculation, are *men*; and of these it is evident his systems and principles of defence demand a large supply, and must incur a great waste.

103. Since the termination of the great war in 1815, the French have been much occupied in constructing and improving the defences of their country; and it is a remarkable fact that their military engineers have nowhere, not even in the works which they have executed for the defence of their capital, adopted any part of the system proposed by Carnot, notwithstanding their admiration of the name and authority of their illustrious compatriot: while the engineers of Prussia and Austria have very extensively followed his principles and methods of construction in the fortresses they have executed for the purpose of resisting future aggression on the part of their neighbours. Yet some of them have indicated their coincidence in opinion with the author of the present work, in regard to his criticisms on the system of Carnot, by their approbation of his reasonings as they were stated in the first edition of his '*Observations on Carnot's Principles of Defence.*'^a The question now to be examined is:—Which of the two schools, the French or the German, is founded on the most correct principles? Are the Prussian and German engineers right in relying on a theory which those of France seem to have repudiated? Are they right in executing,

^a In the preface to a German translation by M. Von Echt (Coblentz, 1821) of the '*Observations on the Motives, Errors, and Tendencies of M. Carnot's Principles of Defence,*' that writer—after remarking that while many persons follow literally the principles of Carnot and Montalembert without comprehending the spirit of those principles—assigns as a motive for presenting a translation of the work to military men, that, "Perhaps no one among the numerous opponents of Carnot has explained his meaning so clearly, nor has supported his objections to the system of that engineer on such precise and sound demonstrations, as Colonel Douglas has done in the work of which the translation is given."

conformably to an untried theory, works on which the safety of their country will depend, by the resistance they should oppose to attacks which, without doubt, will be made upon them in the event of a continental war taking place?

104. The rejection of Carnot's system by the French may afford some presumption that the engineers beyond the Rhine, in adopting that system as the basis of their constructions, have not duly weighed the disadvantages to which it is subject; and this presumption, the author thinks, will be strengthened by the considerations which he has now to offer. Those considerations are founded on his personal knowledge of the works executed by those engineers, and of the localities which have been selected for them; and to these works reference will be made, in describing the details of the constructions. Previously to entering upon this subject, the author thinks it may be advantageous to offer a brief outline of the general principles on which the French fortification (perhaps it may with more propriety be called the early Italian system of fortification) is founded; and to indicate the chief points of difference between that and the modern German, or, as it is called, the Polygonal system.

105. What is called the Bastion system of fortification has long been considered as the perfection of the art of military defence. Every part of the rampart which constitutes the enceinte of a fortress, has its position and dimensions determined on principles which are involved in the very nature of a perfect defence, and of the arms which are to be employed in effecting that defence. In fact, with due modifications, the Bastion system may be said to be equally applicable to the use of all arms, from the javelin which is thrown by the hand to the shot projected from the heaviest ordnance at present in use. Thus, the first principle—that of being able to see the enemy when he may have arrived at the foot of the wall or the rampart—is conformed to, by causing the bastions to project beyond the general

directions of their connecting curtains, and disposing them at such intervals that the parts which reciprocally defend one another shall not be beyond the range of the arms employed in the defence. Whenever this principle is not attended to, in the construction of the enceinte of a place—as when that enceinte is of a form simply circular or polygonal—it is, or should be, always carried out by the construction of works, as ravelins or lunettes, at intervals, in advance of that part of the fortress.

When the Bastion system of fortification was first invented, or adopted, in Europe, the range of the fire-arms employed in the defence of a fortress was estimated at little more than 300 yards; and hence it was found convenient to place the salient angles of every two nearest bastions at a distance, in round numbers, of 400 yards from each other, at the angles of a polygon, imagined to enclose the place; and, with the long-range arms of the present day, this distance might, without departing from the spirit of the system, be extended to 500 or 600 yards. As earth is less subject than masonry to be degraded by shot, the ramparts and parapets were made of earth, the part of the rampart below the level of the ground, and forming one side of the ditch, being alone faced with a wall of brick or stone, in order that the work might not be easily taken by an escalade. The parapets were made about 20 feet thick in their narrowest parts, that they might not at once be perforated by shot from the heaviest artillery then brought against them.

Till the time of Vauban, the practice, in attacking a fortress, was to destroy the parapet and dismount the guns on it by direct fire; but that great engineer having invented the method of ricoching the ramparts by an enfilading fire, the Bastion system lost some of its great advantages: the guns on the faces and flanks of the bastions being, in part, dismounted by shot striking them transversely, as it rebounded along the terre-pleins

on which they were mounted, could no longer defend, by their flanking fire, the ground on which the enemy might advance.

106. The engineers of the French school have long felt the imperfections of the Bastion system, as exhibited in the works of Vauban ; and, though they have retained it in the construction of the enceinte of a fortress, they admit the necessity of considering this part as simply a réduit or retrenchment, in which the last stand against the besiegers might be made ; and they agree in making the principal part of the defence consist in the works constructed beyond the enceinte. Thus, Cormontaigne and Carnot have covered their bastions and ravelins with counterguards, and have greatly enlarged the ravelins, with a view of detaining the besiegers longer in their efforts to get possession of those outworks, and consequently of extending the duration of the siege of a place.

107. The latest French engineers have at length recognised the principle that the best means of prolonging the defence of a place, and of securing the inhabitants of a fortified town, in some measure, from the miseries of a bombardment, is to form about the place a number of detached forts, each strong enough to require a regular siege for its reduction. It was with this view that they constructed the crown works about Alessandria, the lunettes about Antwerp, and the detached forts about Paris. With such works as these about a town, it apparently signifies little what may be the nature of the enceinte itself. The French persist in giving it the bastion form, but the engineers of Austria and Prussia prefer a form approaching nearly to that of a simple polygon. This practice, nearly, is that which has been followed by General Von Aster in the construction of the strong detached work called Fort Alexander, on the Rhine, opposite Coblenz.

When the object is to fortify a rocky height, the French and German engineers agree to execute, on its faces, strong casemates for artillery, in situations which

may command all the approaches, and thus convert the site into a sort of Gibraltar: in this manner have the grounds about Luxembourg and Ehrenbreitstein been fortified.

108. The circumstances which chiefly distinguish the Bastion system of fortification, according to the principles held in the French school, from the Polygonal system of the modern German engineers, are:—1st, the suppression of the bastions on the enceinte, and the establishment of a shell-proof casemate, of brick or stone, across the middle of the main ditch, having embrasures and loop-holes in the side walls for the defence of the ditch, by a fire of artillery and musketry, in the direction of its length: this is to serve the purpose of the flanks of bastions in the system of Vauban, and is supposed to accomplish the end more effectually than these can, it being imagined that the artillery in it is not liable to be dismounted by the fire of the besiegers at an early epoch of a siege; 2ndly, the suppression of the scarp and counterscarp walls, and the substitution for them of a loopholed wall, extending along the whole front of fortification, at a short distance in advance of the exterior slope of the rampart, which is formed entirely of earth. (*See art. 140.*)

CHAPTER III.

ON THE INEFFICIENCY OF VERTICAL OR PITCHING FIRE. EXPERIMENTAL TRIALS OF SUCH FIRING MADE AT WOOLWICH IN 1824.

109. WHEN the author presented a copy of the work, now re-published, to the Duke of Wellington, to whom it was dedicated, a very remarkable conversation took place, and an interesting correspondence ensued on the inefficiency of M. Carnot's vertical fire : on the serious defects and dangers arising from the suppression of the covered way and glacis, and the substitution of a counterslope for the reveted counterscarp of the ditch ; also on the insufficiency of the detached wall before the face of the earthen rampart, to prevent it from being carried by assault, since, as the author has asserted in his work, the detached wall can be breached by batteries placed in the first or second parallel.

110. The illustrious Duke, upon a full consideration of the experiments and reasonings contained in the work, appeared to entertain no doubt of the general inefficiency of the vertical fire proposed by M. Carnot, and of the insecurity of the counterslope ; but, with respect to the practicability of breaching the wall, until a lodgment should have been made on the crest of the counterslope, he demurred much. His Grace seemed to concur at first with M. Carnot, in the opinion that, as the wall could not be seen from any of the earlier works of attack, and could not therefore be fired at directly, it could not be breached, but by batteries established on the crest of the counterslope. His Grace observed that, until a practicable breach should be made from batteries, so to be established against the detached wall, the casemates behind that wall, from which the vertical fire of mortars was to issue, would remain covered and secure ; the exterior

slopes of the earthen ramparts would be protected from assault, and the besiegers established on the crest of the counterslope would be exposed all this time to the destructive effects which M. Carnot attributed to his vertical fire, and to the numerous sorties which might so easily be made from ditches having gentle counterslopes instead of steep counterscarps: whilst the detached wall, remaining till then unseen and entire, would protect the body of the work effectually from any assault. His Grace farther observed very truly, grasping at once the whole question, that the efficiency and security of Carnot's system of defence depended essentially upon the detached wall; and, according as it might or might not answer the expectations, and fulfil the conditions which M. Carnot attributed to it, the whole system must stand or fall.

111. Concurring in this, the author, relying on his own experience as an artillery officer, repeated with the utmost confidence, as is stated in this work (arts. 96, 98), that the Carnot wall, though unseen, might be breached at any part from heavy guns or howitzers placed in the first or second parallel; that shot or shells fired *à ricochet* might be made to pass over, or through the crest of the counter-guard, and strike the detached wall behind it about the middle of its height, or near its foot; that the wall struck would nod forward at every blow; that the shakes and reactions would increase as the blows became more numerous, and the face of the wall would become fractured and dilapidated until, at length, the wall, thus shaken throughout and damaged on its face, would lose its equilibrium, and fall forward in a mass of ruin: its fragments forming a practicable breach or slope in front of that part of the wall which, being too low to be struck by the projectiles, might remain entire. The author ventured to observe that this might be done with so much accuracy and certainty by ricochet firing, that, in besieging any fortress constructed upon Carnot's principle, the process of attack might proceed

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Wethersfield Sept 29th 1819

Dear Mr Howard I will say
I have two copies of your
Lecture cannot stand the
idea of having in the Repository
ce. Would you let me know
if I can get them?

I am the very happy if you
will come & dine & sleep
on Sunday. I have asked
George May. We finish
your letter by the way

with the utmost certainty; that, when arrived at the crest of the counterslope, the detached wall would be found in a state of ruin, at the part or parts on which a sufficiently powerful ricochet fire had been concentrated: when the works of earth, being then uncovered, might be immediately carried by assault.

112. The author then suggested, with great deference to the Duke, that the practicability of breaching the Carnot wall from the first or second parallel might easily be tried, at Woolwich, by causing a facsimile of a fortress on Carnot's system, consisting of parts of the rampart, detached wall, and counterguard, to be constructed; and causing to be erected against it, at 400 or 500 yards' distance, batteries armed with two or three eight and ten-inch howitzers, and 68-pounder carro-nades: from these the firing might be carried on as if at a siege. And, in order that the experiment might be made with as much fairness as possible, it was proposed that the practice should not be corrected by any reports from, or intelligence with a range-party stationed for the purpose of observing the effects produced; the firing party and the committee might remain in, or near the battery, until the number of rounds which had been estimated as adequate to try the case should have been fired. To this the Duke expressed his assent, and this very interesting interview terminated.

113. Soon after this conversation the author received a letter from the illustrious Duke, of which the adjoined is a facsimile.

The author need scarcely say that he accepted with great pleasure the Duke's invitation; and on that occasion he had the honour of presenting to his Grace copies of the publication. During the visit, the author had another favourable opportunity of conversing with that great captain upon the subject of Carnot's system.

114. The author having sent a copy of his work to Major-General the late Sir John T. Jones, of the Royal Engineers—who, acting under the orders of the Duke of

Wellington, attended his Grace in the periodical inspections, made twice a year, of the fortresses which were being constructed or restored on the Rhine and in Belgium—received an acknowledgment which is subjoined in facsimile from that eminent engineer, whom the country has since had the misfortune to lose.

From this letter it will appear that one of the copies of the work, which the author had transmitted to the Duke, had been sent to the Prussian officer charged with the construction of the fortifications at Cologne and Coblenz: the other copy was sent by the Duke to the chief engineer employed in restoring the defences of the Belgian frontier. This officer appears to have acted with more deference to the opinions both expressed and implied in the two letters above noticed, and more in accordance with what may be inferred from the results of experiments afterwards made at Woolwich by the Duke's orders, than the Prussian and German engineers have acted in the construction of the works, the execution of which was confided to them.

115. In 1821 a very important work, entitled '*Mémoire sur l'Effet des Feux Verticaux, proposés par M. Carnot, dans la Défense des Places Fortes,*' was published at Paris by M. Augoyat, Capitaine au Corps Royal du Génie. In this work, M. Augoyat announces his purpose in a preamble, of which a translation is given in the note below.*

* "The true method of defending fortresses consists, according to Carnot ('*De la Défense des Places Fortes,*' Paris, 1812, chap. iv. p. 312), 'à la convertir en une série d'attaques partielles, soutenues par une grande quantité de feux verticaux.' By vertical fires, he means the discharge of hand-grenades, and of any other missiles which can be projected from great and small mortars, howitzers, guns, and muskets, at angles of elevation above the horizon. The object of these fires is not accomplished unless they are extraordinarily multiplied; and for this reason M. Carnot generally uses the expressions, hail or rain (*pluie*) and storm (*torrent*) of fires, to denote the abundance with which the missiles should be employed in the defence. The consumption, however, of an immense quantity of shot, shells, and small balls of iron, being enormously expensive, and perhaps impossible, the distinguished author of the '*Défense des Places Fortes*' supposes that these storms of vertical fires should consist principally of small projectiles, such as stones, grenades, or

My dear Sir Howard;

I return you my best thanks for your friendly recollection in sending me a copy of your complete refutation of the illusions spread by M. Carnot on the superiority of the defence over the attack of fortified places. -

- I have read the work with much attention and have found your reasoning & proof very satisfactory -

The Engineers of the Pays de
never gave much into Carnot
theory, and except at Charleroi
little of his system has been
adopted. but the Prussians
have followed him implicitly
in their works at Coblenz &
partially at Cologne -

I think they will be staggered
when ^{they} receive the copy of
your work which the Duke

promised to send them -
At :hons, the casemates for
vertical fire in the direction
of the salient have been
constructed -

Believe me very
faithfully yrs
John T. Jones -

Woolwich

14th Sept: 1819 -

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116. The author, who was then residing in Paris, transmitted to the Duke of Wellington a copy of M. Augoyat's '*Mémoire*,' with a letter, of which the following is a copy :—

(Dated) "Paris, July 26, 1821.

"My Lord,—

"The accompanying '*Mémoire*' (just published at Paris) '*sur l'Effet des Feux Verticaux, proposés par M. Carnot*,' has been sent to me by the author. I take the liberty of transmitting it, for your Grace's perusal, satisfied that your Grace will consider the subject of such importance as to require no apology for this intrusion.

"The author of the *Mémoire*, M. Augoyat, is a very distinguished officer of French engineers, and Professor of Fortification à l'Ecole d'Application de l'Etat Major, lately established at Paris.

"It is very satisfactory to me to present to your Grace a work which, upon a close investigation of M. Carnot's system (with reference, mainly, to the book which I dedicated to your Grace), has fully admitted the 'accuracy' and 'importance' of my observations, and adopted (page 34) all the conclusions I have drawn, leaving the question as it was when M. Carnot took it up, namely, that vertical fire, applied in the manner recommended by Vauban, Cormontaigne, Bousmard, St. Paul, and others, is a powerful accessory in the de-

balls, weighing a quarter of a pound, fired from mortars, and musket-bullets discharged at elevations of about forty-five degrees. He calculates the effect which all these projectiles would produce on the approaches of the besiegers, between the third parallel and the place: and he arrives at the conclusion, that the besieging army, however strong it might be, would be destroyed in ten days; and, consequently, that the fortress might be considered as impregnable. Several writers have published critical observations on Carnot's work: in France, General Gassendi ('*Aide Mémoire à l'usage des Officiers d'Artillerie*,' 5^e édit. Paris, 1819); in Russia, Colonel Weliminoff ('*Mémoire sur le Profil en Fortification*,' par le Colonel Stolipine, Pétersbourg, 1816); in Germany, General Eickmayer (*Abhandlungen über Gegenstände der Staats-und-Kriegs Wissenschaften*, Frankfurt-am-Main, 1817); and others (Pallas, ix^e et x^e cahiers, année 1810; '*Nouvelle Feuille Militaire Périodique de Vienne*,' ix^e et x^e cahiers, année 1813; '*Traduction Allemande de la Défense des Places Fortes*'); and, finally, Colonel Sir Howard Douglas, whose work ('*Observations on the Motives*,' &c.) should be cited, as containing the results of some interesting experiments on vertical firing, and just observations concerning the systems of M. Carnot. My object in this *Mémoire* is to collect the experiments which have been made on vertical fire, to calculate the effects which they may produce, and to compare together its employment, in the system of defence proposed by Carnot, and in that which is generally adopted. I shall frequently cite the work of Sir Howard Douglas, which has supplied me with most of the facts, and with the most important observations. I have added to these data some other facts, together with the calculations and the developments which appeared to be necessary, in order that the subject might be more perfectly understood."

fence of places, but that it cannot produce the effects M. Carnot has calculated; that he has pushed the application much too far, and has erred in principle; that he has exaggerated the difficulty of serving ordnance placed on the ramparts of a fortified place; that his project would render it impossible either to man the covered way or the ramparts upon the points attacked, and consequently oblige the besieged to renounce the important operations of cannonading, and opening fire of musketry upon the third parallel, heads of saps, cavaliers of the trenches, and the crowning of the covered way, and consequently that M. Carnot's system is actually indefensible.

"I have reason to know that this is not only the opinion of the individual who has thus adopted and avowed my conclusions; but that the work speaks the judgment of the corps to which the author belongs, and may be considered as sentence passed upon M. Carnot's propositions and new system, by a body of men certainly not prejudiced against him, nor in favour of a British military author.

"The attention of the French engineers to this controversy, has been excited by two important questions:—one to consider how far M. Carnot's system should be acted upon, in carrying into effect some contemplated additions to the defences of this kingdom; the other, to apply the investigation to estimate the powers of resistance of those fortresses which are being erected, according to M. Carnot's system, upon an opposite frontier.

"The former of these questions may now be considered as set at rest; and the corollary of the proposition is, *satisfaction that the Prussians are acting upon an erroneous, insecure, and condemned system.*

"Having published my work under very strong impressions of the serious consequences that must, in all probability, ensue, to affect our interests should any application of M. Carnot's projects be carried into effect, on frontiers which we are interested in strengthening, and may have to defend; and being now brought to view the question with increased confidence in my original opinions, I entreat your Grace to receive, with indulgence, this communication. Your Grace having done me the honour to recommend my book to the perusal of the Prussian engineers, will, perhaps, further submit the subject, together with this letter and the accompanying Mémoire, to their reconsideration; and if your Grace's superior judgment should be disposed to confirm the opinions thus expressed and supported, the defective plans upon which our late and probably future allies are acting, may yet be abandoned and corrected.

"(Signed) H. DOUGLAS."

"Field Marshal His Grace

The Duke of Wellington, K.G., G.C.B." &c. &c.

The Duke acknowledged the receipt of the author's

Saturday Nov - 19 - 1821

My dear Sir I am very much obliged
to you for the second copy which you
have sent me of the work by a General
Officer as a present. I received the post
for sent me and wrote you thank
you for it. I gave it to General
Inglan at 10 thirty after seeing
it.

I propose to go down up Reading
I resume the experiments commenced
at the Howard College

This year in November going with
Orlando of the larger cables.
I expect that we shall find it.
I must perfect them as the able &
a certainty even with reduced
charges I shall be able to build
the Russian have constructed
a point of 8 feet head from the
Eastern point to instead of
the lower point. If we can
- and this spot we shall

completely destroy the new
system of fortification.

Ever dear to your mother
faithfully W. H. W. H. W.

communication, and the 'Mémoire' accompanying it, in a letter which bears with so much force upon the subject of a controversy which, having lain apparently dormant for nearly 40 years, becomes now a matter of deep interest on account of its influence on the territorial arrangements of Europe, as settled in 1815, that the author is induced to present here a facsimile of it.

117. In 1822, the Duke of Wellington—doubting, as it appears, whether a sufficient number of shots or shells, fired *à ricochet*, could be so accurately directed from the first or second parallel as to pass over the crest of the counterguard and strike the wall proposed by Carnot, low enough to make in it a practicable breach—caused some preliminary experiments to be made, in order to ascertain this point before authorizing the expense of building, in masonry, an exact representation of a portion of the wall, with a corresponding portion of the counterguard.

For these preliminary experiments, the left face of the bastion erected in the Arsenal at Woolwich, for ricochet practice, was raised high enough to represent a portion of Carnot's counterguard, and, at the proper distance behind it, was formed a bank of earth to represent the detached wall. The experiments, which were made in 1822, were, upon the whole, sufficiently successful to satisfy the Committee that in firing from the first or second parallel, in a siege, the wall might be struck, at the required height from the ground, by such a number of shot as would afford a reasonable expectation that a wall built in masonry, according to Carnot's proposal, could be effectually breached. Accordingly his Grace recommended that the necessary constructions should be executed, and the experiments duly made.

The following table exhibits the results of the artillery practice carried on in 1822, as a preliminary measure against the works intended to represent a portion of a Front of Fortification, according to Carnot's system.

NATURE OF ORDNANCE.	Range.	Charge.	Elevation.	No. of Rounds fired.	Shot or Shells struck the wall at the under- in feet from the top of the									
					1 to 2.	2 to 4.	4 to 6.	6 to 8.	8 to 10.	10 to 12.	12 to 14.	14 to 16.	16 to 18.	
24-pounder iron, 9 feet. . . .	Yards. 400	lbs. oz. 12	deg. 10	No. 37	No. 2	No. 5	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	
24 " " " " " " " " " "	400	1 ..	9½	30	3	2	1	1	4	1	1	1	1	
68 carronade shot " " " "	400	1 ..	9½	30	4	2	1	2	1	2	1	1	1	
" " " " " " " " " "	400	1 ..	9½	20	2	2	4	1	2	2	1	1	1	
" " " " " " " " " "	400	1 4	7½	30	2	2	1	6	1	2	1	1	1	
" " " " " " " " " "	400	1 14	11½	20	1	1	1	1	3	1	1	1	1	
" " " " " " " " " "	400	1 ..	9½	40	2	2	4	2	1	1	1	1	1	
8-in. iron mortar " " " "	400	1 6	10	40	3	2	1	1	2	1	1	1	1	
Total, elevation not exceeding 11½° . . . . .	..	..	..	247	13	17	11	12	9	12	1	1	1
24-pounder iron, 9 feet. . . .	500	1 9	10½	40	2	1	1	2	1	1	1	1	1	
8-in. iron howitzer " " " "	500	1 4	9½	40	2	1	1	1	1	2	1	1	1	
" " " " " " " " " "	500	1 8	7½	20	1	1	1	1	1	1	1	1	1	
10 " " " " " " " " " "	500	2 ..	10½	30	2	1	2	1	2	2	1	1	1	
" " " " " " " " " "	500	1 10	9½	30	3	1	3	3	2	1	1	1	1	
68 carronade shot " " " "	500	1 4	9	40	2	3	2	4	1	2	2	1	1	
8-in. iron mortar " " " "	500	1 11	10	40	2	5	2	1	2	1	1	1	1	
Total, elevation not exceeding 10½° . . . . .	..	..	..	240	10	12	10	12	9	9	4	1	1
Total at 400 and 500 yards, elevation not above 11½°	..	..	..	487	23	29	21	24	18	21	4	1	1
8-in. iron mortar " " " "	400	1 ..	15	20	1	1	2	1	1	2	1	2	4	
" " " " " " " " " "	400	1 ..	15	40	1	2	1	2	1	1	2	1	1	
8-in. iron howitzer " " " "	400	1 11	15	50	5	2	4	2	1	7	1	1	1	
" " " " " " " " " "	400	1 11	15	30	1	1	2	3	1	2	1	2	2	
10 " " " " " " " " " "	400	1 3	15	30	1	1	1	1	1	2	1	3	2	
" " " " " " " " " "	400	1 3	15	30	1	1	1	4	1	1	1	1	2	
68 carronade shot " " " "	400	1 11	15	40	3	1	3	4	1	2	1	1	2	
" " " " " " " " " "	400	1 13	15	30	1	1	3	1	3	1	1	1	1	
Total at 15° . . . . .	..	..	..	270	10	6	16	17	7	15	9	10	14
8-in. iron mortar " " " "	500	1 5	15	40	1	1	1	1	1	1	3	3	1	
" " howitzer " " " "	500	1 14	15	40	1	1	2	1	4	1	3	1	1	
" " " " " " " " " "	500	1 14	15	30	1	1	1	1	1	1	1	1	2	
10 " " " " " " " " " "	500	1 8	15	30	2	1	1	1	2	3	2	1	2	
68 carronade shot " " " "	500	1 13	15	40	1	1	1	2	1	2	3	2	2	
" " " " " " " " " "	500	1 ..	15	30	1	1	1	1	1	1	1	1	1	
Total at 15° . . . . .	..	..	..	210	6	3	4	5	8	7	11	7	6
Total at 400 and 500 yards, elevation 15° . . . . .	..	..	..	480	16	9	20	22	15	22	20	17	20
Total fired during the practice . . . . .	..	..	..	967	39	38	41	46	33	43	24	18	20

. The Table is formed as follows:—All those shot which struck as low as two feet are included in column 1 to 2; all those those which grazed or struck superior cope of counterguard, and cut through and then

mentioned distances wall.				Effects.					Of the Number of Rounds fired,				
18 to 20.	20 to 22.	1 to 12.	12 to 22.	Total on the Wall.	Passed wall and struck Ram-part of Bastion.	Struck or lodged in Ram-part of Counter-guard.	Short.	Over.	Proportion which took effect		Proportion which struck Counter-guard, fell short, went over, &c.	Proportion of No. which struck wall between 12 and 22 feet.	
No.	No.	No.	No.	No.	No.	No.	No.	No.	On Wall.	On Ram-part of Bastion.	No.	to No. which took effect on wall.	to No. of rounds fired.
..	..	8	..	8	11	5	11	2	nearly $\frac{1}{4}$	..	..	..	..
..	..	11	..	11	4	14	1	..	more $\frac{1}{3}$	..	..	..	..
..	..	12	..	12	3	11	3	1	more $\frac{1}{3}$	..	..	..	..
..	..	10	..	10	2	5	3	..	$\frac{1}{2}$	..	..	..	..
..	..	10	..	10	16	2	2	..	$\frac{1}{2}$	..	..	..	..
..	..	4	1	5	7	3	5	..	$\frac{1}{2}$	..	..	..	..
..	..	9	..	9	18	4	8	1	nearly $\frac{1}{2}$	..	..	..	..
..	..	10	..	10	10	7	8	5	$\frac{1}{4}$	..	..	..	..
..	..	74	1	75	71	51	41	9	about $\frac{3}{10}$	$\frac{3}{10}$	$\frac{3}{5}$	$\frac{1}{15}$	$\frac{1}{17}$
..	..	6	1	7	10	11	10	2	nearly $\frac{1}{4}$	..	..	..	..
..	..	6	..	6	7	15	9	3	nearly $\frac{1}{4}$	..	..	..	..
..	..	2	..	2	6	9	2	1	$\frac{1}{10}$	..	..	..	..
..	..	10	1	11	6	10	1	2	more $\frac{1}{10}$	..	..	..	..
..	..	13	..	13	3	8	6	1	more $\frac{1}{10}$	..	..	..	..
..	..	14	2	16	7	6	10	1	$\frac{1}{2}$	..	..	..	..
..	..	11	..	11	15	6	8	..	not $\frac{1}{4}$	..	..	..	..
..	..	62	4	66	54	65	45	10	more $\frac{1}{4}$	not $\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{10}$	$\frac{1}{20}$
..	..	136	5	141	125	116	86	19	about $\frac{2}{4}$	more $\frac{1}{4}$	more $\frac{3}{10}$	$\frac{1}{25}$	$\frac{1}{27}$
2	..	4	7	11	5	1	3	..	more $\frac{1}{2}$	..	..	..	..
..	..	6	6	12	6	10	12	..	near $\frac{1}{2}$	..	..	..	..
..	..	21	3	24	13	4	2	7	near $\frac{1}{2}$	..	..	..	..
..	1	7	6	13	8	7	2	..	near $\frac{1}{2}$	..	..	..	..
..	2	5	8	13	9	6	2	..	near $\frac{1}{2}$	..	..	..	..
..	3	6	7	13	11	6	..	..	near $\frac{1}{2}$	..	..	..	..
..	..	13	3	16	15	2	6	1	$\frac{2}{3}$	..	..	..	..
3	..	9	4	13	9	6	2	..	near $\frac{1}{2}$	..	..	..	..
5	6	71	44	115	76	42	29	8	more $\frac{2}{3}$	$\frac{1}{10}$ not $\frac{1}{4}$	$\frac{2}{27}$ more $\frac{1}{10}$	more $\frac{2}{3}$	near $\frac{1}{2}$
1	1	4	8	12	11	9	7	1	near $\frac{1}{3}$	..	..	..	..
..	..	8	4	12	11	5	7	5	near $\frac{1}{3}$	..	..	..	..
..	1	2	3	5	13	9	3	..	$\frac{1}{6}$	..	..	..	..
1	1	7	7	14	11	3	1	1	near $\frac{1}{3}$	..	..	..	..
1	..	6	8	14	8	6	10	2	more $\frac{1}{3}$	..	..	..	..
..	1	6	1	7	13	8	1	1	near $\frac{1}{3}$	..	..	..	..
3	4	33	31	64	67	40	29	10	more $\frac{2}{3}$	$\frac{1}{10}$ near $\frac{2}{3}$	$\frac{2}{3}$	not $\frac{1}{2}$	more $\frac{1}{2}$
8	10	104	75	179	143	82	58	18	not $\frac{2}{3}$	$\frac{1}{10}$ not $\frac{2}{3}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{10}$ or $\frac{1}{2}$
8	10	240	80	320	268	198	144	37	..	..	..	..	..

as low as four are in the column 2 to 4, and so on; those which grazed the top of the wall are returned as being over; struck the wall, are returned as having produced an effect on the wall.

118. The works which the Duke of Wellington had recommended to be executed at Woolwich—to serve as objects by which the question, whether Carnot's wall could be breached or not by distant firing, was to be determined—being completed, and the masonry of the wall firmly consolidated, the experimental operations against the wall took place in August, 1824.*

A portion of either face of the middle bastion in the plan opposite p. 53 (fig. 1), with corresponding portions of the wall in the ditch before it and of the covering counter-guard, will serve to indicate the situation of the works in the general plan; and the part between B and D (fig. 2), will represent a section of those works as they existed before the firing began.

The following is a copy of a 'Report of the Practice carried on at Woolwich in 1824, by order of His Grace the Duke of Wellington, Master-General of the Ordnance'—

"His Grace the Master-General having considered it possible that the walls used in the new system of fortification, recommended by Carnot, and carried into execution in late years in different countries, might be breached at considerable distances by fire at high angles, desired in the year 1822, that a profile in earth might be prepared for trial, placing a screen of the proper height in lieu of a wall.

The experiment tried at Woolwich in August, 1822, proved that this fire could reach very low down the

It was doubtful, however, whether the projectiles would breach the wall at considerable distances, say of one hundred yards, considering the small quantity of powder which it was necessary to use.

His Grace the Master-General then determined that he would continue the experiment, and had a wall constructed of the usual dimensions in the summer of 1824. It was 24 feet high and 22 feet long, of the

* See 'Practical Orders of the Corps of Royal Engineers,' vol. ii. p. 45.

regular thickness of six feet at top and of seven at bottom, as recommended by Carnot, and had one loophole in the usual recess. It was *further strengthened by a buttress of four feet square at each end*, so that the total length of the wall, including the buttresses, was 30 feet at bottom and 28 at top: *the buttresses giving it a considerable additional strength beyond the usual wall of Carnot's system. The wall was carefully built and well cemented.* An earthen counterguard, of the regular thickness and of equal height with the wall, was thrown up before it: the crest of the counterguard being 20 yards from the top of the wall.

"A mound of earth representing the rampart of a bastion was thrown up behind the wall, and was continued at the regular slope of 45°, till its height was four feet above that of the wall; *but this rampart being eight feet lower than the real rampart of a bastion would have been, was on that account of less use in serving as a correction to the elevation of the ordnance.*

119. "Two batteries were constructed against the wall, and opened their fire 5th August, 1824. They consisted of the following pieces of ordnance:—

8 68-pounder carronades, at 500 yards	} at 400 yards	} from the crest of counterguard.
3 8-in. iron howitzers,		
3 10-in. ditto		

14 pieces.

"100 rounds per piece were fired in about six hours: the howitzers firing live shells filled with powder, the carronades firing solid shot.

"On examining the wall, there was a practicable breach of 14 feet wide, and the buttresses were much injured; as will be more distinctly shown by reference to fig. 1, page 100.

"The splinters of the shells being inconvenient to the men in the 400 yards battery, the bursting powder of the shells was considerably reduced.

"On the 6th August, the firing recommenced from

8 68-pounder carronades, at 500 yards.	
2 8-in. iron howitzers,	} at 400 yards.
4 10-in. ditto ditto	

—
14 pieces.

"The fire of these pieces was intended to be directed towards the more effectual opening the breach, and the more complete destruction of the buttresses.

"50 rounds per piece were fired in two hours, when the breach was examined and found to be complete in every respect, and the buttresses to be in the ruinous state more clearly shown by reference to the darker shade of fig. 1, and also to fig. 4, page 101.

"On the 5th and 6th of August, 2 of the 8-inch iron howitzers, 2 of the 10-inch ditto, and 4 carronades, *had been placed upon high traversing platforms, so as to raise them nearly to the natural level of the country, according to Carnot's system; but His Grace the Master-General, who examined the breach at this period, having given directions that all the ordnance should be placed on common platforms, the use of the traversing platforms was discontinued. It had been previously observed that no advantage or superior accuracy of fire attended raising the guns, which was merely done that the experiments might more scrupulously follow Carnot's system, with respect to the relative levels of the wall, the counterguard, and the country.*

"His Grace also ordered that the rubbish should be cleared away both from the front and rear of the breach. This was accordingly done, when the wall was found to be about five feet in perpendicular height in front, with a ~~rounding~~ of rubbish of about two and a half or three feet on the top, and to be about eight and a half or nine feet in height towards the rear, or *chemin des rondes*, ~~as shown in fig. 5, page 101.~~

"On the 11th August the batteries recommenced ~~their fire from~~

8 68-pounder carronades, at 500 yards.

6 10-in. iron howitzers, at 400 yards.

14 pieces.

"Eighty-five rounds from each of the howitzers, and about 100 from each of the carronades, were fired in three hours and a half, by which time the wall and buttresses were one mass of ruin, and the *chemin des rondes* was obliterated, as is shown in the view and elevation, figs. 2 and 3, overleaf.

"The power of artillery to destroy Carnot's wall has been, therefore, fully established; the guns having received no aid as to charge, direction or elevation beyond what real service would afford, and the shells having in some measure been less efficacious than they really would be from the circumstance of so much powder having been taken out of them after two hours of the first day's fire, on account of the splinters reaching the batteries, and that a very considerable number of shells did not explode.

"From careful observation, it appeared that about a quarter of the shells and one-fifth of the shot struck the wall. Many of both which but just missed it would have been efficacious had the wall been longer.

"The increased rapidity of the fire is also observable: that of the third day being nearly double that of the first day, although the reduction in the height of the wall, from 21 to 5 feet, rendered the operation obviously more difficult.

(Signed)

"R. DOUGLAS,

"Lt.-Gen., Director-General F.T."

The figures 1 to 5 overleaf, represent the appearances of the wall at the operations on each of the three days respectively; and the experiments satisfactorily demonstrate the practicability of effecting a breach in Carnot's wall, at the distance of 400 or 500 yards, by firing *à ricochet* over the counterguard.

Fig. 1.



Fig. 2.

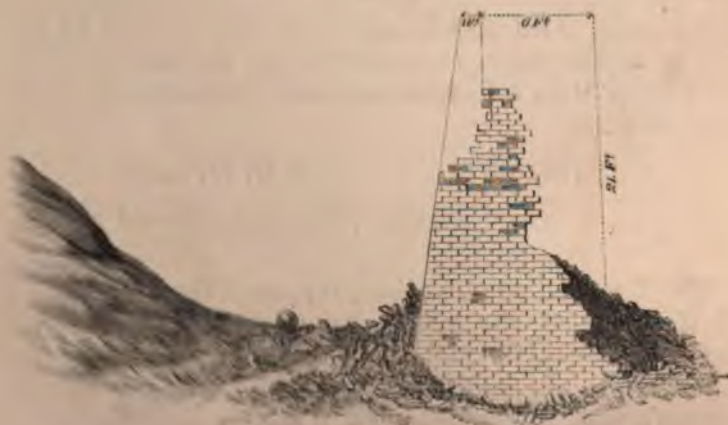


Fig. 3.



Fig. 4.



Fig. 5.

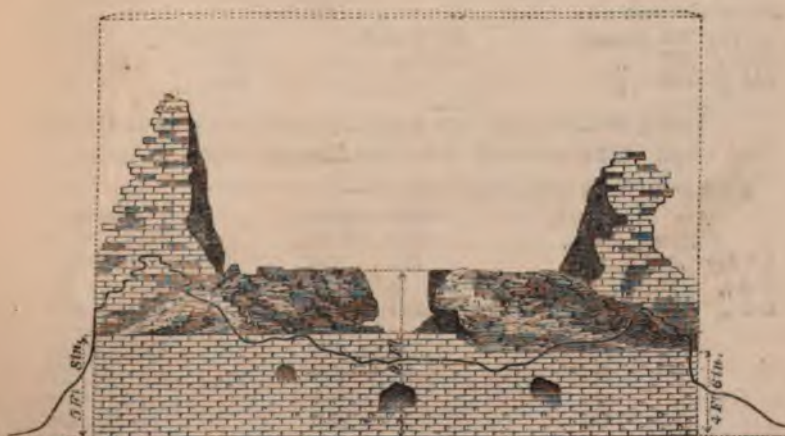


Fig. 1.

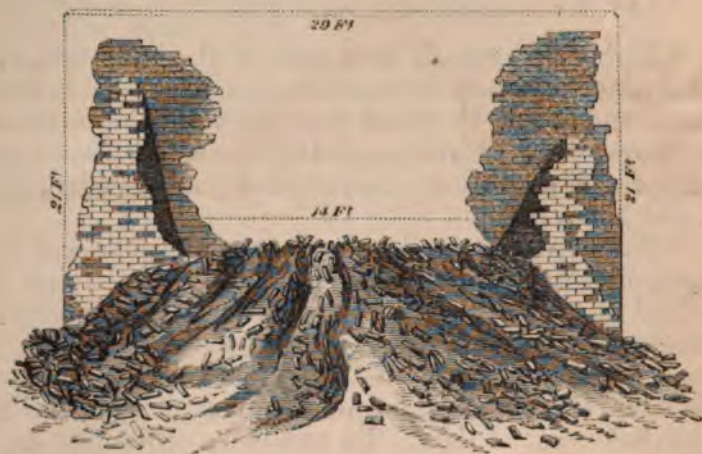


Fig. 2.

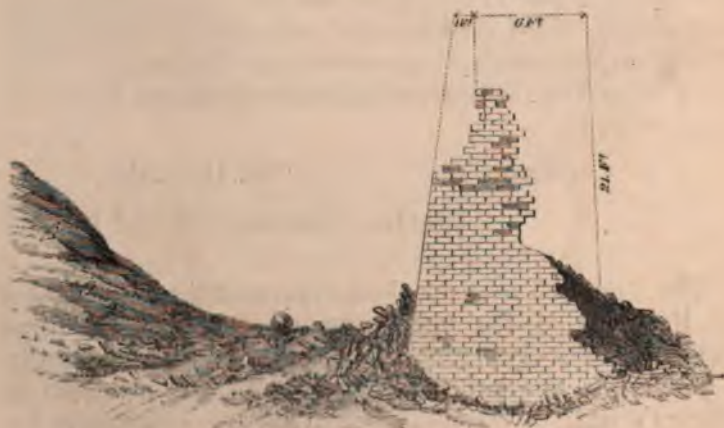


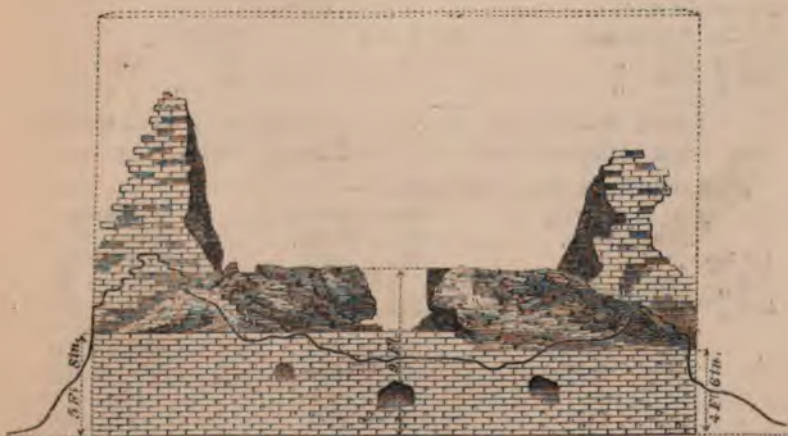
Fig. 3.



Fig. 4.



Fig. 5.



The following interesting particulars, relating to the experiments, were, subsequently, communicated to the author :—

CHARGES.

	lb. oz.		lb. oz.
10-in. Howitzer	1 3	for the two first days,	1 2 the last.
8-in. "	11	"	None "
68-pr. Carronade	1 0	"	14 "

ELEVATIONS.

	deg.	deg.	deg.
10-in. Howitzer	12½ first day	12½ second	13½ last.
8-in. "	13½ "	13½ "	None.
68-pr. Carronade	13 to 14.		

FUZES.

	in.	in.	in.
8 and 10 in. Mortars	1.1 to 2.2	2.2 "	2 "

BURSTING POWDER.

	lb. oz.	lb. oz.	lb. oz.
10-in. Mortars	5 0	to 2 10	or 3 0
8-in. "	2 8	" 2 0	" 1 14

Orders were previously given to vary the elevation according to circumstances. It was intended that the shells should strike before bursting, and after thirty rounds the fuzes were of 2.2 in. The firing was from right to left; by salvos (two or three); and independently, taking care not to have two shells in the air at once.

Mem. of the weight of iron fired :—

	lb. oz.	lb.
10-in. Shells with	2 10 bursting powder	96
8-in. "	1 14 "	48
Carronades shot ..	.. ..	68
1st day 300 10-inch	300 8-inch	800 68 pr.
2nd " 200 "	100 "	400 "
3rd " 536 "		800 "

$1036 \times 96 = 99,456$ $400 \times 48 = 19,200$ $2000 \times 68 = 136,000$
 Total weight 113 tons 15 cwt. 56 lb. Total rounds 3436

Shot and Shells which took effect :—

	Against the wall.	Counterguard.	Bastion.
	Shot. Shells.	Shot. Shells.	Shot. Shells.
1st day	180 58	192 190	No return.
2nd "	36 58	128 111	92 65
3rd "	73 86	204 176	235 216
	289 202	524 477	327 281
	289 289	524 524	327 327

120. The results of the experiments made in 1824 having fully verified the predictions of the author, and the expectation entertained by the Duke of Wellington after the preliminary trials of 1822,—that the wall constructed according to the system of M. Carnot might be breached by ricochet fire from batteries placed in the first or second parallel; and the inefficacy of vertical fire having been proved practically by the experiments detailed above: it would seem that the engineers of the allied armies employed under the Duke's supervision—to whom copies of those experiments were immediately transmitted—should have been deterred from persisting in the adoption of a theory which was thus shown to be erroneous, and from applying it in the construction of fortresses or points of defence of the utmost importance to the security of the countries to be protected from aggression.

This ill-founded theory has, however, been adopted to a vast extent, and fortresses have been built at enormous cost by the Prussian and German engineers, at points of vital importance to the preservation of those territorial demarcations which were laid down in the treaties of peace of 1815, and on which the safety of Europe depends.

121. Whilst these works were being constructed on principles which the Duke of Wellington, as well as the engineers of the British and other services, deemed vicious, the French engineers appear to have watched their progress with intense interest. They abstained, however, from pronouncing in any published work their reasons for not having adopted the Carnot system themselves. It was not their business to throw the weight of their conviction of the defects and insecurity of that system into the scale in such manner as to deter the Prussian and German engineers from constructing, on erroneous principles, fortresses and other military points which France might have to attack: but now that those works have either been completed, or are so far advanced as to be no longer susceptible of being modified or reformed, the French engineers cease to observe that

silence which they have hitherto maintained upon the very important professional controversy respecting the merits of the new system; and they consider that the time has come when they may propound their reasons for having repudiated it, and expose scientifically its weak points. In so doing, they teach the modes and means by which, in the event of war, the fortresses which the French may be destined to encounter, at the first step which they may have to take beyond the limits of their present territory,^a may best be attacked and reduced.

122. In the important work just referred to, M. Mangin examines closely:—First, the three great principles of defence upon which the Carnot system is founded, viz., the detached scarp;^b the suppression of the counter-scarp, covered way and glacis, with the substitution of the glacis *en contrepente*;^c and vertical fire of small balls from mortars placed in casemated batteries.^d Having examined and condemned the new principles of defence seriatim, M. Mangin proceeds,—Secondly,—to examine the strength and resistance of the new system of German fortification, in which those principles of defence are largely introduced; and, after an elaborate, skilful, and eminently scientific investigation of that mixed system, he expresses the opinion of the whole corps of French engineers, that the polygonal system, based upon those vicious principles, is defective, dangerous, and insecure.

123. Before proceeding to examine the new German system by applying to it an attack *en règle*, as has been done with respect to the Carnot system in the former part of this work,^e and by M. Mangin, in his ‘*Mémoire sur la Fortification Polygonale*,’^f it is proposed to examine the opinions entertained by the engineers of France in general, and by some of those in the British service, on the efficacy of that system, borrowed by the

^a ‘*Mémoire sur la Fortification Polygonale construite en Allemagne depuis 1815*, par M. Mangin, Capitaine de Génie.’—*Preface*.

^b Sect. 8, p. 20, et seq.

^c Sect. 16-26, p. 29, et seq.

^d Sect. 27, p. 45, et seq.

^e Arts. 80, 81, 82.

^f Sect. 5, et seq.

Prussian and German engineers from Montalembert and Carnot, with a view to inquire how far principles already—by engineers of the first eminence in the French and other military services—deemed vicious and defective in the several systems for which they were originally proposed, can be less so in those which are formed by combinations of both. We may observe here, that the Carnot wall is but a revival of the old town-wall, which—incapable of resisting the effects of modern arms and means of attack—was abolished when massive ramparts of earth were formed; and, hence, to detach the scarp from the body of the rampart may be considered rather as making a retrograde than an advancing step in defensive science.

124. M. Mangin observes, in the work above quoted, that, “since the detached scarps may be destroyed by the besiegers’ batteries in the first parallel, the safety of the place is at an early period of the siege endangered: this defect alone should induce engineers to reject such scarps; but the evil is increased by the flanking parts of the enceinte being destroyed at the same time—so that the place is at once deprived of the most important property of fortification, that of securing the place from an attack by main force.

“With respect to regular attacks, the detached scarps, with *chemins des rondes* which they leave on their interior side, have the defect of allowing the besieger, after passing the breach in the wall, to extend himself about the place, and assail it on a wide front: he may thus easily execute his lodgments and batteries on the works within the wall, or form galleries in them to discover the countermines which the defenders may have prepared.

“As to the defensive qualities of the detached scarps, they are of small importance; from their loop-holes the crest of the besiegers’ crowning batteries can scarcely be perceived: so that the fire from them is no obstacle to the construction of those batteries, and defends the ditch very imperfectly. These walls may, moreover, be breached at their salient angles: through

such breach the *chemin des rondes* may be enfiladed in its whole length ; and, consequently, it must be immediately abandoned by the defenders." (' *Mémoire sur la Fortification Polygonale*, sect. 90, p. 145.)

In another place (sect. 11), Capt. Mangin remarks, "Since the besiegers have it in their power, they would not fail, by means of their distant batteries, to open the works in several places at the same time ; and the garrison would be deprived of the advantages of having interior defences, unless they should be of extravagant dimensions. In the bastion system, the formation of retrenchments is possible, because a regular attack is confined to one front, or to two fronts ; but in the new system, there being no supposed necessity for breaching-batteries near the ditch, the point of attack may be said to be on the whole circuit of the place, and retrenchments ought to be formed within every front. In a small place, a central redoubt might serve the purpose ; but, in a large place, a second enceinte would become necessary."

125. In confirmation of the practicability of breaching the detached scarp by ricochet firing from the first or second parallel, M. Mangin, besides alluding (page 45) to experiments made in Germany, adduces the results of those carried on at Woolwich in 1824, of which an account has been given above (Art. 119). He adds, that the only advantage of casemates in the Polygonal Fortification is, that they form shell-proof coverings for the mortars or howitzers, and thus secure both the ordnance and the gunners. This advantage, however, is not considerable, since, in the bastion system, the pieces are usually placed on parts of the ramparts which are the least exposed to ricochet fire ; and it will be found, perhaps, that the money expended in the construction of the casemates might be more usefully employed for other purposes. (*Mémoire sur la Fortification Polygonale*, sect. 27, p. 45).*

* In a note written by Major-General Sir John Burgoyne, G.C.B., and inserted in Sir John Jones's '*Journal of Sieges*,' the soundness of Carnot's principles of defence is briefly questioned ; and the gallant officer stated, subse-

126. It has been asserted by Colonel Humphrey ('*Essay on the Modern System of Fortification*,' 1838, p. 7, note), with regard to the experiment made at Woolwich in 1824, that it was carried on under every disadvantage to the wall, inasmuch as the latter was only recently built; and the position of it being exactly known, the range, to a foot in length, was ascertained, which of course could seldom happen on service; and another Englishman, also an advocate for the detached wall, observes ('*An Essay on a proposed new System of Fortification*, by James Fergusson.' London, 1849, p. 54)—"The advantage of these detached scarps has been a good deal called in question, in consequence of an experiment carried on against one at Woolwich in the year 1824, but with every possible advantage in favour of the attack. Now, as the possibility or impossibility of breaching the wall is a point of fundamental importance in the principles of Carnot's system of defence, if the possibility is proved by facts, the circumstance is fatal to those principles, as far as the detached wall is concerned. We refer the reader to the passages printed in italics in the copy of the Report of the Special Committee which conducted those experiments; and in which it is stated that the wall was strengthened considerably beyond that which is described in Carnot's work, that it was carefully built and well cemented in 1823, and was left to dry and consolidate for the period which intervened be-

quently, to the author of this work, his gratification in finding that the complete refutation of those principles, in the former edition of this work, corroborated the general views which he, Sir John Burgoyne, had taken of them.

The unfavourable opinion of another eminent military engineer, General Sir Charles Pasley, respecting the system of M. Carnot, contained in the edition of 1819, may be seen in his reference to Carnot's work, which is made in the new edition of his '*Elementary Fortification*;' and may be further inferred from his recommendation to the author of this work, the former edition being out of print, that a new edition should be published, in which the experiments of 1824 should be inserted at length, together with such matter and information as he might be able to procure from those who had followed him in his attack, "efficient and successful," Sir Charles was pleased to designate it, of that system. Sir Charles Pasley added, that such a work, brought up to the present time, was much wanted.

tween that date and August, 1824. Besides this testimony in favour of the strength of the wall in the experiment, M. Mangin observes, in the work above quoted (sect. 8 et seq.)—"The experiment (at Woolwich) proves the weakness of detached scarps; since such were destroyed by a fire of short duration, from a battery situated at a distance greater than that of a second parallel. In the experiment, moreover, it was necessary to fire at considerable angles of elevation, in order to hit the lower part of the wall; but in Carnot's trace the crest of the glacis, instead of being at 20 yards from the scarp, is above 60 yards from it, and the terrepleins of the besiegers' batteries are much more elevated than in the experiments at Woolwich: the fire from these batteries would therefore be more horizontal, and its effects consequently more destructive."

Captain Madelaine also, the translator of and commentator on Colonel Humphreys' Essay, above quoted, remarks ('Fortifications de Coblenz,' Paris, 1846), in answer to the observation that the Woolwich experiment was carried on under circumstances advantageous for the attack and unfavourable for the defence,—“That in the experiments, the wall, though recently built, must have had solidity; since, instead of ordinary mortar, the bricks were laid in Roman cement, which has the property of hardening very quickly. Secondly, The besiegers would, no doubt, be provided with good plans and profiles of the works to be attacked, from which they might ascertain exactly the position and distance of the wall, and consequently might determine the spot at which a battery should be placed, quite as well as it was known in conducting that experiment; and it should be observed that, of 3300 rounds fired, only about one-fifth took effect on the wall, which, however, was destroyed from the top almost to the bottom” (pp. 47, 48). And after observing that, while the enemy is at a distance, the configuration of the works on the plan is not of decisive importance, he adds (page 45)—“Since the defenders cannot prevent the enemy from approaching the ramparts, at least he ought to be compelled to

proceed slowly, and to arrive at the foot of the glacis only after having experienced severe loss. This would not be the case with an enceinte like that of Coblentz, with a profile like that of Carnot, having its scarp-wall detached from the rampart and its counterscarp in the form of a glacis, since the scarps might be breached by batteries situated at a considerable distance from it; and the besiegers, pursuing the retreating sorties of the garrison down the gentle counterslope, might enter the place pellmell with the defenders."

127. The objections that have been made by the advocates of Carnot's wall to the fairness of the experiments of 1824, which conclusively prove that the detached wall might be breached by ricochet fire, though protected by an earthen work in its immediate front, have been thus disposed of; and the same experiments may be adduced as proofs of the facility with which the caponnières of masonry and other casemated batteries in the ditches might be breached by fire from batteries in the first or second parallel, if placed on the prolongations of the ditches. We now proceed to consider the next point in the Carnot system, viz., the suppression of the counterscarp, covered way, and glacis, and the formation of a glacis en contre-pente.

On this subject, Captain Mangin—after having shown ('Mémoire sur la Fortification Polygonale,' p. 36) that anciently the covered way or corridor was very narrow, furnished during the time of a siege with a double row of palisades, and the places of arms very small—observes that, nevertheless, the sorties from the covered way were frequent, and often led to important results. After remarking also that the cause of sorties being now less frequent than formerly, is not the difficulty of marching out of the covered way, but the existence of the parallels which connect the approaches, which enables the besieger to bring up his troops in force, and thus compel the sortie to return to the place with loss, and without seriously retarding the operations of the enemy,

tact with the enemy, and from whence he may continue to make sorties, or fire his countermines. On the other hand, with a glacis countersloped, as soon as the crest is crowned, the whole length of the ditch may be swept by artillery; the defenders have no longer the power of making sorties, nor can they even keep troops collected in the ditches: in fact, the active defence, instead of being facilitated, becomes nearly impossible.

"We may remark, also, that none of the casemates in the ditches will serve as a place of refuge for troops which have been repelled after making a sortie; for it is to be apprehended that the besiegers, in pursuing those troops, will enter the casemates with them; and, once established in these vaulted buildings, the besieged, unable to see the interior, will scarcely be able to dislodge them.

"To the preceding considerations must be added others relating to the sorties which may be made in the ditches. In the fortifications of the school of Vauban, when the enemy has penetrated into the ditch by a subterranean descent, and has no other line of communication by which his miners may be supported, it is easy to perceive that the defenders may issue by night, and even by day, from behind the extremities of the tenaille; may cross the ditch rapidly, destroy the head of the gallery, and return under cover, without incurring any danger except from a few musket-shots fired hurriedly, and almost ineffectually, from the crest of the glacis at the salients. This advantage is entirely due to the existence of the covered way with the reveted counterscarp, by which the guard of the trenches would be prevented from approaching the sortie, in order to attack it while crossing the ditch."

"The assault of the enceinte is also greatly facilitated in the system of Carnot, in consequence of the covered way being suppressed. The troops destined for the attack, instead of being obliged, as in the system of Vauban, to defile through a narrow subterranean gallery, and afterwards to crowd together in the ditches, exposed to all the fire of the place—frequently without the power either of forcing the narrow breach

or of effecting a retreat—may, with a glacis countersloped, remain in the crowning lodgments on that work till the moment of commencing the descent: they then, in a few seconds, gain the scarp; and, in the event of being repelled, they may return without disorder into their trenches—the fire from which would prevent any pursuit being made by the defenders.

“Even before the breach is made, the entire nakedness of the enceinte will oblige the garrison to keep an incessant watch on all the fronts, as soon as the enemy has arrived in the environs of the place. The difficulty that the besiegers would experience in escalading the detached wall, and in getting down on the interior side, cannot be considered as equivalent to the security which the garrison derives from the covered way and the reveted counterscarp.

“In what has been said, it has been supposed that the place is surrounded by a detached wall à la Carnot, for the breaching of which no batteries were specially required. Should the rampart be of earth only, as at Germersheim, the counter-batteries would not perhaps suffice to make practicable breaches in them: yet from those batteries the scarp might be degraded, the detached wall which covers the terreplein at the salient angle might be destroyed, as well as the loop-holed walls which have at great expense been built in rear of the casemates for mortars: these casemates might be rendered untenable, and their communication with the scarp galleries be ruined, which would enable the besiegers to gain the postern leading to the interior of the place, or would facilitate the establishment of mines, the explosion of which would open the rampart, and expose the place to an immediate assault. Should these operations not have complete success, at least while they are being executed, nothing could prevent the besieger from constructing batteries for the express purpose of breaching the enceinte, and the assault would be postponed for a few hours only.” (*Mémoire sur la Fortification Polygonale*, pp. 62-64.)

128. Another distinguishing feature in the new system

of fortification is, the great curvilinear redoubt of masonry (brick or stone) which is formed at the gorge, or in the interior of the detached works about the enceintes of the places (the redoubt of Fort Alexander at Coblenz for example), and which generally consists of three tiers of casemates. With respect to such redoubts, it may be remarked that, when the defenders have been compelled to retire into them, it would be possible to confine them there, as in a trap, by means of lodgments formed on the rampart of the work about the redoubt. The latter being curvilinear, the fire from it is necessarily divergent, and consequently of small effect at any particular spot: in order to silence it, it would be merely necessary to breach a small extent of the wall. This being effected, the besieged—continually subject, in confined situations, to a fire of shot from the enemy's batteries, and harassed by splinters from the walls themselves—can scarcely be expected to make a vigorous resistance. But it may be asked—How are such redoubts to be breached? To this it may be answered, that a breach may be effected by a fire from heavy ordnance in batteries which may be formed in the second parallel. Shot discharged from such ordnance, at small elevations, would suffice to ruin the wall of the redoubt, already weakened by the number of embrasures with which it is pierced. ('Fortifications of Coblenz,' par J. Madelaine, Capitaine en Retraite, pp. 33-35.)

129. On the subject of M. Carnot's third point of defence by vertical fire, the reader is referred to the original edition (Arts. 27, 29 of the present edition) of this work, and to the notice taken of it in the third edition of 'Jones's Sieges,' 1846 (vol. ii., p. 353), in which the inefficiency of Carnot's vertical fire of small balls is fully stated. M. Mangin, also, having observed ('Mémoire sur la Fortification Polygonale,' sect. 27, p. 45), that the projectiles (stone balls) would not put a man *hors de combat*, unless they should fall directly on his head, adds, "many expedients may be found to protect the men from the effects of these projectiles: for example, helmets of

basket-work, as recommended by Vauban, or of leather, as proposed by Rogniat; or even small sheds formed at intervals in the trenches, the roof consisting of hurdles and covered with fascines. This last expedient has been employed in several sieges, particularly in that of Dantzic, in 1807; where the great use which the defenders made of stones and grenades proves, not only that the disposition of the works permitted an extensive employment of that nature of projectiles, but also that they were not very dangerous to the besiegers. In the attack of a place, the danger from them would be so much the less, as the men, instead of working slowly up a glacis, descend the counterslope almost with the rapidity of the flying sap. It is, therefore, evident that the revolution which Carnot supposed he had introduced in the art of defence by the employment of vertical fire, is in this respect quite unfounded. It would be useful, no doubt, to multiply such projectiles, but they ought to be of sufficient calibre to render them destructive to the enemy; and, then, we fall back upon the usual mode of defence, and no new method is introduced.

130. There is no doubt that, though a vertical fire of musket-balls or of stones is inefficient, as proved by the experiments reported above, yet iron balls, or grape-shot with balls of one pound weight, would be sufficient to put men, who might be struck, *hors de combat*; and, in the event of this subject being reconsidered at a future time, we may refer to the 'British Aide Mémoire to the Military Sciences,' (Art. *Vertical Fire*), in which are described experiments made by the officers of the Bengal Artillery with a 13-in. mortar fired at an elevation of 45°, and charged with 900 4-oz. balls. From these experiments, it appears very probable that such shot, if they fell upon men, even at a distance of 160 to 170 yards, would be far more efficient than M. Carnot's balls of 1-oz. weight; and it may be admitted, that vertical fire of any description may be considered as a powerful accessory in defensive warfare, though, as a principal means of defence, it could not be relied on. The casemate-vaults behind the detached wall would certainly, as we have shown, be

destroyed by the shells from batteries in the first and second parallels; and, even if vertical fire could be rendered more efficient than at present, this would not compensate the serious defects of Carnot's system, particularly the destructibility of the detached wall, the suppression of the counterscarp and outworks, and the substitution for it of *glacis en contrepente*.

131. With respect to shell-firing in general, in the attack and defence of places, we refer to what has been already stated, in proof that this, as an accessory, is recognised and prescribed by all the great masters of the art of defence, quite as far as it can be applied with any advantage. (See Arts. 60 to 63 above, for the opinions of Vauban, Cormontaingne, Bousmard, and St. Paul, on the employment of vertical fires.)

The author has already asserted that shell-firing in general is uncertain; and that, instead of superseding, it can only be considered of use to second the fire of round shot; he has added, that mortars or howitzers are comparatively of little use, either in destroying the defences of a place, or in keeping down the fire of the besiegers. Cormontaingne observes also, that shells do little injury to the besiegers; for, if the fire from mortars be vertical (at high elevations), not more than 1 shot in 100 falls in the works or trenches; and, if horizontal, the shot does little injury. We have the like testimony from the Duke of Wellington. His Grace states,* "I recollect that, at the siege of Ciudad Rodrigo, our trenches were bombarded by 11 or 13 large mortars and howitzers for ten days—in which time 13,000 shells were thrown—which occasioned us but little loss, notwithstanding that our trenches were always full; and I may safely say they did not impede our progress for one moment."—The illustrious Duke adds: "With respect to the use of mortars and howitzers in a siege, I am quite certain that they answer no efficient purpose against the defences or the garrison: they act chiefly against the inhabitants

* Despatch dated Lesaca, 23rd August, 1813, 'Wellington Despatches,' vol. xi. p. 32.

of the place. And if, as it happened at the time the breach was first practicable at St. Sebastian, a general bombardment should set fire to a besieged town, as it probably would, the attack would become impracticable; and eventually, should we get possession of the place, we should be deprived of the convenience we might otherwise obtain from it—that of having the houses of the place in a habitable state. I do not believe that the use of our mortars and howitzers, at St. Sebastian, did the enemy's troops the slightest mischief.

“These are my opinions, and I have invariably acted upon them, when I had the means; and, where there has been a partial departure from those opinions, as there was at the second siege of Badajoz, it arose from the want of other ordnance.” The want alluded to was that of guns, as the Duke felt severely afterwards at Burgos, the siege of which he undertook with three 18-pounder guns, the other five pieces of ordnance being only 5½-in. iron howitzers or chambered guns.

The despatch from which these extracts are made is a remarkable document, and may well be quoted to pay tribute to the sagacity of the Duke of Wellington, who was then fully aware of the defects of chambered ordnance, at least for warfare on land, whatever may be said in their favour for the naval service. (‘Naval Gunnery,’ Arts. 253 *et seq.*)

P A R T I I.

ON THE MODERN GERMAN OR POLYGONAL SYSTEM
OF FORTIFICATION.

132. HAVING examined separately the new principles of defence, which are common, nearly, to the systems of Montalembert and Carnot, we proceed to examine the modern German system of fortification, which is founded on those principles, with a view to enquire in what respect the defects and inefficiencies of the two first systems are fatal to the other, which is a mixed system compounded of both. The reasons given by engineers of the new German school for abandoning altogether the bastion system may be briefly stated as follows:—

133. When Vauban, by the introduction of ricochet firing, by the invention of parallel trenches, and by other great improvements, had fully established the superiority of the means of attack over those of defence—so that the issue of a siege became a certainty, and its duration was reduced to a question of time—the necessity of introducing some modifications in the construction of fortresses, and of making improvements in the defensive art, was generally acknowledged by all engineers: and various expedients were devised accordingly, in order to avoid the destructive effects of enfilade or ricochet fire, by Vauban himself in his second and third systems. Cormontaigne, Coëhorn, Bousmard, Dufour, and others have also attempted to remedy the defects in construction, which left fortresses exposed to such effects. But, notwithstanding the ameliorations which these great men introduced in the construction of fortresses, the balance still rests—where Vauban left it—in favour of the attack, against places not strong from the natural advantages of their site; and it has ever since been more or less a subject of professional

controversy, whether a fortification with bastions admit or not of being improved ; and, of late, whether bastions should or should not be retained.

134. Amongst those who declare themselves openly against the bastion system in principle, and who reproach the French engineers for having made no attempt to raise the defensive art to that superiority which Vauban destroyed, Montalembert and Carnot have made themselves conspicuous, by asserting that this restoration can only be obtained by a total abandonment of all the existing plans, and an entire alteration in the formation of the profiles.

The essential principle of Montalembert's system is that the artillery of the place should always be superior in number to that of the besiegers. For this he proposes to construct, in masonry, vast casemated works, having several stages or tiers of guns completely protected from the fire of the enemy.

His observation is, that the safety of places depends on the covered fires which they can oppose to the attack of the works. "I flatter myself," he adds, "that I have succeeded in collecting within a small space the greatest fire of artillery and musketry of which any idea can be formed, with apertures so multiplied that the men may breathe in the casemates with as much freedom as in the open air. . . . It will not be possible to doubt that the double batteries of guns, and triple batteries of musketry, are so usefully placed in the fortress that they will be capable of destroying and reducing to dust all the parapets which a besieger can form against them : hence the impregnability of such fortress necessarily follows." (*'La Fortification Perpendiculaire,'* tom. i. pp. 137, 138.)

135. The following remarks are from M. Mangin's *'Mémoire sur la Fortification Polygonale,'* sect. 5, p. 11 :—"It is stated, in favour of the Polygonal system, that it permits the defenders to place on the ramparts a greater quantity of artillery than would be possible on an enceinte with bastions ; and that it compels the besieger to give greater lateral extent to his works, in

order to embrace the fronts attacked. But it will be easy to show that this circumstance gives to the polygonal trace so little advantage over the other, that it may be safely disregarded. In fact, on the rampart of an enceinte having the form of a simple polygon, it may be possible to place 390 pieces of artillery in opposition to the besiegers' batteries : while on a bastioned enceinte, having the same number of fronts, only 260 pieces could be placed, to answer the same purpose. This last number of pieces is, however, greater than it has been found possible to employ in any fortress hitherto besieged. The number of men required to serve this quantity of artillery is far greater than it has been found possible to maintain or employ in any fortress hitherto besieged ; and the amount of labour in executing and keeping in repair so many embrasures, platforms, and traverses, would exceed the powers of any garrison which it would be prudent to leave in a place. The reasoning of Montalembert is, therefore, without force, practically speaking : it may be observed also that the besieger has greater facilities than the defender for extending his operations ; and he has the advantage of being able to occupy, with his artillery, positions which permit him to employ that convergency of fire in which the superiority of the attack to the defence in a great measure consists.

“As to the increase of the siege operations consequent upon the greater extension of the fronts of attack, it may be observed that this relates wholly to the parallels, of which the second would be about 800 yards, and the third about 150 yards longer than would be necessary in an attack on a fortification with bastions ; but this additional extent of work would not retard for a single day the progress of the attack, if the operations were performed with the usual means.”

136. M. Montalembert assumes that, in the face of such a formidable artillery fire as the defenders may keep up, neither counter nor breaching batteries can be established, nor can the passage of the ditch be effected : he thinks that the powerful effect of the

grazing fire (*feu rasant*) of so many guns placed in casemates for the security of the ditch, allows him to dispense with flanking ramparts; and, consequently, to renounce altogether the bastion system. The same engineer, likewise, makes great alterations in the profile of his works. In the greater number of his projects, he detaches the scarp from the earthen ramparts, and provides this detached wall with loopholes: thus converting it into a continuous line of casemates for musketry. The caponnière defences, and the detached wall which protects the body of the place, are covered from ricochet fire by works in front.

Bousmard, speaking of the principles which should guide the engineer in endeavouring to improve the art of fortification, observes ('*Essai Général de Fortification*,' tom. iv. p. 3, édit. 1814), that they consist in increasing the difficulties of the attack and the facilities of the defence, and not in loading the ramparts with artillery. He adds, "Montalembert congratulates himself on the strength which he had found means to give to the work which he designates *Fort Royal* (a work formed on a square), in having provided no less than 1024 guns for the defence of one of the fronts. Now it has happened here to Montalembert as it will always happen to persons who would improve fortifications without knowing anything of the arts of attack and defence. One system-maker may have heard that artillery principally is used in the defence of a place, and immediately he places vast numbers of guns, tier above tier, in casemates, on every front; another may have a vague notion that multiplied fires of musketry within the ramparts of a place contribute mainly to prolong the defence, and he fills every work with retrenchments, so that there is not sufficient space left for the troops to manœuvre; and, the defence failing somewhere, the whole is rendered useless."

137. Carnot, as we have shown, adopts Montalembert's proposition for detaching the scarp-wall from the rampart, and likewise makes an extensive use of masonry works, casemated batteries, *batteries blindées*, and capon-

nières; but his defence consists principally in a different employment of the artillery.

Instead of opposing vigorously the opening of the trenches, the establishment of batteries, and all the early and distant operations of attack—which was the method proposed by Montalembert—Carnot keeps his artillery fire in reserve until the enemy approaches the glacis, where he would crush him by a hail of stones projected at considerable angles of elevation from his casemated mortar batteries; and he would complete the destruction of the besiegers by continual sorties. To facilitate these, he suppresses the counterscarp of the ditch, considering it an impediment to these movements; and he transforms it into a gentle counterslope, renouncing entirely the covered way and the ordinary glacis, and even dispensing with other outworks. By this new method, he proposes to obtain the great objects which Montalembert had in view; and both of these engineers concur in renouncing entirely, or considerably modifying, the bastion system. The tracings of Montalembert and Carnot have been rejected by the French engineers, and neither of them has been adopted entirely by the disciples of the new school in Germany and Prussia; but these last, availing themselves of the main principles upon which the two systems are founded, have concocted a mixed system, which they call polygonal, and which they have adopted in almost all the fortresses which have been constructed since 1815. These we are now to examine.

138. The French engineers deny not the necessity of making modifications and improvements in the trace of the bastion system, in order to avoid as much as possible the destructive effects of ricochet fire from batteries placed on the prolongations of the ramparts of the place; and also in the form of its profiles. They acknowledge, besides, the necessity of using various expedients for placing the artillery of the place, its garrison and munitions of every description, more in security from the fire of the besiegers; and of rendering the main works more capable of resisting the powerful ordnance of the present and coming time. For this

purpose, they think it is necessary to abandon as much as possible all masonry defences, and to substitute earthen works: this is, in fact, the chief difference between the two schools. But they propose to retain, in the rampart of the place, the great principle of collateral defence, which forms the peculiar distinction of the bastion system, whether in permanent fortification or in the occupation of a defensive position by troops in the field; for, as it has been justly said, a well-occupied position, in which the defensive arms are well combined, forms, in principle, a fortification ambulante.

Admitting the necessity of improving the bastion system, Bousmard observes (*Essai Général de Fortification*, tom. iv. p. 3, édit. 1814), "It would not be unreasonable to call upon engineers, who, both from theory and practice, are profoundly acquainted with the means by which fortified places should be attacked and defended, to discover means of disposing the works so that the besiegers should encounter greater difficulties and obstacles in the attack, and that the means of defence should be rendered more powerful: such," he adds, "is the only route to be pursued in seeking to improve the important art of fortification."

139. Dufour, in his work entitled '*De la Fortification Permanente*,' (pp. 41, 42, 92, 93) rejects the detached wall, though he adopts the assumption of Carnot, that, not being seen, it cannot be breached until a lodgment shall have been made on the crest of the work in its front. His work not having been published before the experiments at Woolwich, in 1824, that assumption had not then been disproved; yet he rejects the wall for other reasons, which are stated at page 94 of the work. Far from renouncing the bastioned trace, he retains it in all its integrity for the body of the place (see his Plates V., VI., and VII.), and he alters only the trace of the outworks, giving more saliency to the ravelin. He gives greater command to the parapet at the angle, in order to defilade the remaining portion of its faces from ricochet fire. He changes materially the redoubt in the ravelin, and considerably improves the defences of the re-entering places of arms.

140. The German and Prussian engineers, instead of seeking to improve, entirely abandon the bastion system, and adopt one which may be described in a general way as follows :—The works are supposed to be constructed on a polygon, each side of which is about 500 yards in length : the rampart of the enceinte is sometimes broken so as to form short brizures or flanks, having a casemated battery at the foot of each. Before the middle of the curtain, is formed, for the defence of the ditch, a vaulted caponnière of masonry, resembling a bastion ; its faces are defended by the somewhat oblique fire of the brizures above mentioned ; and they are covered by a ravelin, whose faces may be defended by casemated batteries at their extremities. The sides of the polygon, about the angles, are sometimes covered by counterguards ; in which case there are casemated batteries, in the faces of the ravelin, for the purposes of defending their ditches. At other times, a casemated réduit is formed in the prolongation of the gorge of the ravelin, by which the ditch of the enceinte and ravelin may be defended.

At the foot of the enceinte, of the ravelins, and of the counterguards, on the exterior side, is generally a detached loopholed wall, covering a corridor or *chemin des rondes* ; and the exterior side of the ditch is formed with a gentle counterslope. Sometimes the ramparts are reveted on the exterior in the usual manner, with what are called counterarches.

The caponnière is sometimes closed at the gorge, and separated from the curtain—which is the case at Fort Alexander near Coblenz : sometimes it is connected with the curtain, its flanks being prolonged towards the rear till they meet it—which is the method employed at Germersheim. At Rastadt, the faces are prolonged till they meet the re-entering angles of the enceinte. Occasionally, also, casemated caponnières are formed before the angles of the polygon, as in the forts about Cologne. The description above given is applicable to the fortresses and forts on the Rhine ; while, in other places, as at Verona, similar works have been combined with bastioned fronts.

141. With respect to the advantages claimed by the

time that the artillery of the defenders is withdrawn from them that they may become useful in the defence, by giving to the troops occupying the ramparts, shelter preferable to that which can be afforded by the temporary constructions hitherto adopted during the siege. And perhaps this property, joined to that of affording better protection from ricochet firing, would render them worthy of general adoption, notwithstanding the great expense of their construction.

It is justly observed that, in a fortification with bastions, the flanks of those works have the disadvantage of diminishing the interior of the place, and the artillery upon them is liable to be dismounted by the shot which ricochets the adjacent faces; and this circumstance is that which has been most generally objected to: but it is easy to see that the defect is not felt at the early period of the siege; and it may, subsequently, be obviated by the construction of a *parados* in the bastion ricoched. Should there be a cavalier in the bastion, the artillery of the flank is effectually protected by it from any fire in reverse.

The suppression of the usual wall at the scarp and counterscarp of the ditch, leaves the place exposed to the danger of being taken by a sudden assault, the detached wall above mentioned being liable to destruction by a pitching fire of shot and shells from the distant batteries of the besiegers; and the casemated batteries in the ditch cause a serious impediment to the communications which should be made along it. In place of them, it would probably be better to form casemates in the flanks of Vauban's bastions or of his *tenailles*, like those proposed by Bousmard, or those made by Chasseloup de Labat in the works executed for Napoleon I. about Alessandria: these would most effectually defend the ditch at the time of an assault being made, and would leave it free for communications till the last moment of the siege.

142. The polygonal system of fortification has been executed, either entirely or partially, at many places in Germany and Prussia; and a brief notice of the

fortifications of Coblenz, with a detailed description of Fort Alexander, near that city, chiefly from the plans and descriptions of Colonel Humfrey ('Essay on the Modern System of Fortification,' London, 1838), will serve as specimens of that system.

The town of Coblenz is situated in the angle formed between the Rhine and the Moselle, and along both rivers is a loopholed wall of masonry, strengthened at intervals by cavaliers. On the side next to the country, the rampart, which is of earth, is broken so as to form a succession of very obtuse angles, alternately salient and re-entering, and the whole is covered by a detached wall. The faces, or brizures, are flanked by casemated caponnières placed in the re-entering angles, which defend the ditches on the right and left, and each flank carries several guns, in two tiers. The enceinte is surrounded, at different distances, by detached works, which defend the approaches to the place: the works are of different forms, and have apparently been adapted to the nature of the ground, as well as to the purposes of mutual defence. Almost all of them have, at the gorge, a réduit of masonry with two, and even three stages of casemates, and those of the most importance are provided with galleries for countermines and subterranean communications.

The principal of these detached works is Fort Alexander, which is situated on the plateau of Hundsriich, at about 900 yards from the town, and is formed on a parallelogram nearly rectangular. The character of the work is very similar to those of Montalembert's *Fort d'Orléans* and *Fort Royal* ('La Fortification Perpendiculaire,' tom. ii., pp. 171, 233). Both of these have short, oblique flanks with casemated caponnières in the ditches. The latter is formed on a square, each side of which is 360 yards: it has also an envelope, with a covered way and a glacis. The following illustrations and description of the plan of one front of Fort Alexander will serve as an example of the German system, whatever be the polygon on which the works are constructed.

Fig. 2.
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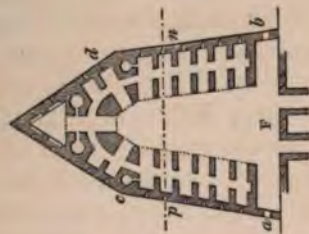


Fig. 4.



Fig. 1.

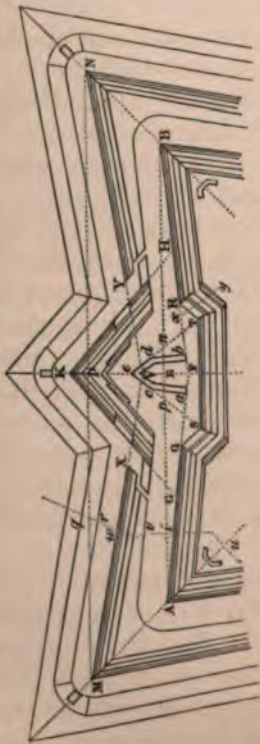


Fig. 3.



Fig. 5.



The principal front, *AB* (fig. 1, p. 128), of the enceinte of the work, is about 500 yards long, and the lines of defence, *AF*, *BF*, make, with *AB*, angles of six degrees nearly. Let *F* be the point of their intersection, and let a line, as *KF*, be drawn through it perpendicular to, and bisecting *AB* in *E*. Make *FG*, *FH*, and *FK* each equal to half of *AF*; then the lines *KG* and *KH* will be the directions of the faces of the ravelin. Let the lines *AM* *BN* bisect the angles of the parallelogram on which the works are constructed (if the enceinte were polygonal these lines would bisect the angles of the polygon), and draw *MN* parallel to *AB*, through a point, *P*, in *FK*, at the distance of 110 yards, measured from *F*: the line *MN* may be considered as the side of an exterior polygon, and its length will vary with the nature of the polygon. In Fort Alexander it is about 670 yards long.

The demigorges *Fa*, *Fb* (figs. 1 and 2), of the casemated caponnière, are each 50 feet long, measured from *F* on *FA* and *FB*: the flanks, *ac*, *bd*, which are perpendicular to those lines, are each 90 feet long; and the faces *ce*, *de*, coincide with the sides of an equilateral triangle, whose base is a straight line joining *c* and *d*. The ditch of the enceinte is 30 yards broad. The brizures *QS*, *RT* (fig. 1), are perpendicular to the faces *ec* *ed* of the caponnière, and are drawn from the points *Q* and *R*, which are found by making *AQ* and *BR* each equal to one-third of *AB*. The faces *MX*, *NY*, of the counter-guards are drawn from *M* and *N* to a point *V*, on *KF*, at 25 yards from the point *E*, and their ditches, as well as those of the ravelin, are 20 yards broad. On the principal front, only, of Fort Alexander, the exterior side of these ditches has the form of a reverse glacis, which is 20 yards broad.

Fig. 2 is an enlarged plan of the caponnière at the centre of the main ditch, in fig. 1. Fig. 3 is a transverse section of the same work, in the direction *pn*, fig. 1. Fig. 4 is a section across the short flank *TR*, fig. 1. Fig. 5 is a section or profile across the enceinte (*u* to *i*), the main ditch (*i* to *v*), the counter-

guard (*v* to *w*), its ditch (*w* to *r*), and the countersloping glacis (*r* to *q*): the parts corresponding to those are marked with the same letters in fig. 1.

The right and left fronts of Fort Alexander are each about 440 yards long; and, on the middle of the side which is nearest to Coblenz, is a large curvilinear réduit of masonry, carrying two tiers of guns, in casemates, besides a battery on its roof: this keep is connected with the sides of the fort by a straight wall, which forms the gorge of the work. The ramparts are of earth, and a corridor, or *chemin des rondes*, a few feet below the level of the natural ground, is formed on their exterior: this corridor is covered by a loop-holed wall. (See *i* and *w*, fig. 5.)

The principal front of this fort extends to the right and left, quite across the elevated plain on which the work is formed: the descent of the ground on each side is so rapid that a besieger would not be able to find any situation in which he could place batteries to ricochet the ramparts of that front.

Besides Fort Alexander, Coblenz is protected by detached works on the opposite side of the Moselle: these occupy a ridge of ground rising about 100 feet above the river. The most advanced of these, on approaching from Treves, are the Moselle and the Bubenheim flèches, which are capable of defending each other. Opposite the interval between these, and towards their rear, is Fort Francis, a strong, casemated, and countermined work, which commands the former works by several feet, and is inattackable by escalade: it is also capable of defending by its fire the ground in front of the town, on the opposite side of the river. All the three works have strong, casemated réduits at their gorges, and it would be impossible to approach the town, on this side, without previously taking them.

On the right bank of the Rhine, opposite to the junction of the Moselle with that river, is the great citadel of Ehrenbreitstein, which is situated on a rock 400 feet above the water. It is inaccessible on three sides, and, on the fourth, it is strengthened by a double

intrenchment. It constitutes the key of the position, and contains casemates for the whole of its garrison, with the artillery and stores. It commands all the surrounding heights, and is strengthened by small detached works in situations from whence they may look into hollows which could not be seen from the principal work.

143. The method of fortifying places which has been adopted by Prussian engineers (see fig. 1, p. 134), differs but little from that which has been just now described. The side of the polygonal enceinte, which is about 500 yards long, is scarcely, or not at all, indented with brizures, in its whole length; and on the rampart of the enceinte, which is of earth, there is frequently, at each angle of the polygon, a casemated building (*a, a*, fig. 1), like the Haxo Battery, for artillery or musketry: this extends towards the interior, in the direction of the capital, by which it may serve either in firing upon the enemy's approaches at a distance, or as a traverse, to protect the ramparts of the polygon from being enfiladed. There is also within each angle of the polygon, on the general terreplein, a strong, casemated redoubt of masonry, serving as a fortified barrack or a réduit, being pierced with embrasures for artillery, or loopholes for musketry. A loopholed wall, detached in front of the rampart of the enceinte, in the manner of Carnot, covers a *chemin des rondes*, whose terreplein is a little above the level of the bottom of the ditch, and vaulted passages lead to it from the interior of the place, through the thickness of the rampart.

A rectangular, casemated battery, PQ, shell-proof, extends quite across the main ditch, at the middle of the front: its sides are pierced with embrasures, in two or more tiers, for the artillery which is to serve for the defence of the main ditch.

A large ravelin, formed on an equilateral triangle, is constructed beyond the main ditch: its rampart being similar to that of the enceinte, except that, in about half its length, on each side of the salient angle, it is

raised considerably higher than it is in the part nearer the gorge. This is a construction which was proposed by Bousmard, and is intended to protect the parts of the faces nearest the main ditch from being enfiladed by fire from the besieger's first batteries. The rampart, at the part near the salient angle of the ravelin, is formed with a short front (*e, f*, fig. 1, p. 134), perpendicular to the capital of the work; and in this part are four vaulted casemates, to contain mortars which may throw large shells on the distant parts of the approaches, or showers of balls on an enemy, when near the rounded part of the ditch about the salient angle. In front of these casemates is a terreplein, below the level of the natural ground, in the form of a triangle, and constituting a termination to the ravelin, at its salient point. On this terreplein defenders may be drawn up to resist an assault, and the two faces of this terreplein are protected by loop-holed walls, from which the defenders may annoy the besiegers by a fire of musketry, directed against their lodgments near the ditch.

At the place where each face of the ravelin terminates on the main ditch, there is formed a casemated redoubt, *M, M*, from which a fire of artillery or musketry may be made, in order to defend the ground before the ravelin and the angles of the enceinte; and the casemates *N, N*, afford flanking fires to defend the ditch of the ravelin, in the direction of its length. The gorge of the ravelin is occupied by a strong, casemated building, *RS*, of a semicircular or semielliptical form, which may serve as a barrack, or as a réduit, for prolonging the defence of the work. The Prussian engineers have not always adopted the glacis *en contre-pente* of Carnot, for their ditches are sometimes formed with a counterscarp wall, as in the works of Vauban.

Fig. 2 (p. 135), represents a profile across the rampart of the enceinte, its ditch and countersloping glacis, in the direction *AB, BC* (fig. 1, p. 134). Fig. 3 is a longitudinal section in the directions *DEF* (fig. 1); and fig. 4 is a section across the rampart of the ravelin, its ditch and glacis, in the direction *FGH*.

Fig. 1.

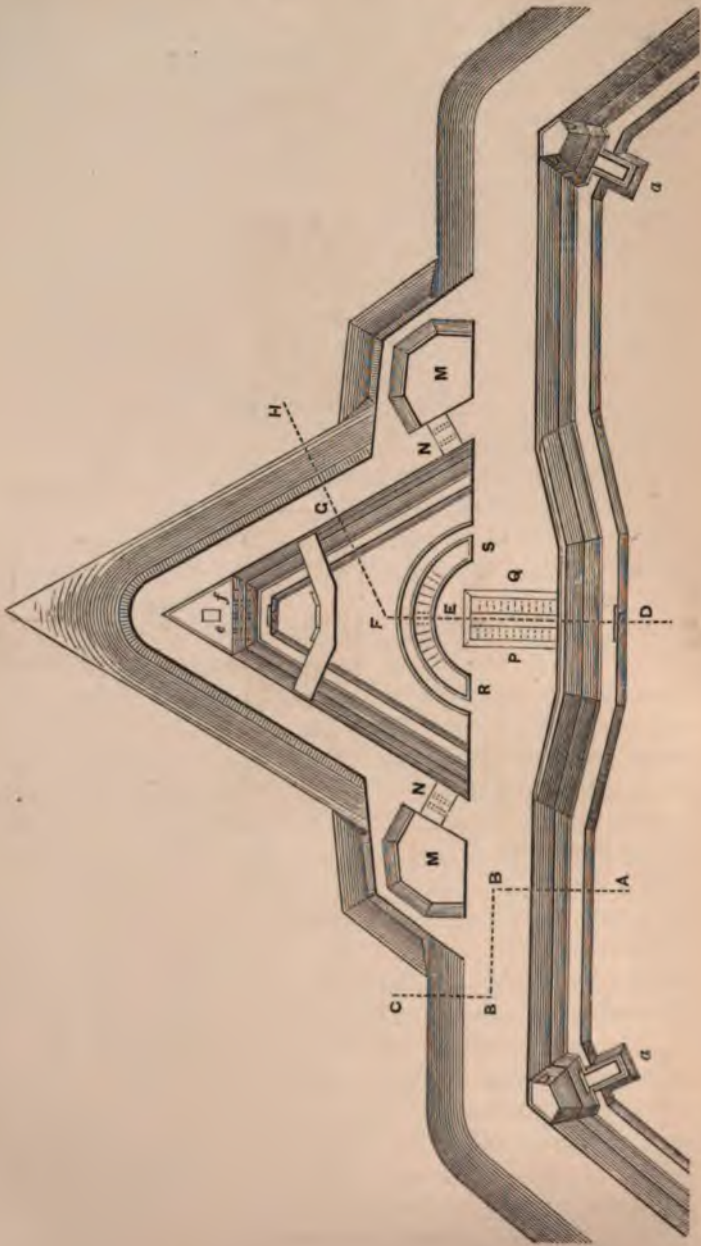


Fig. 2.

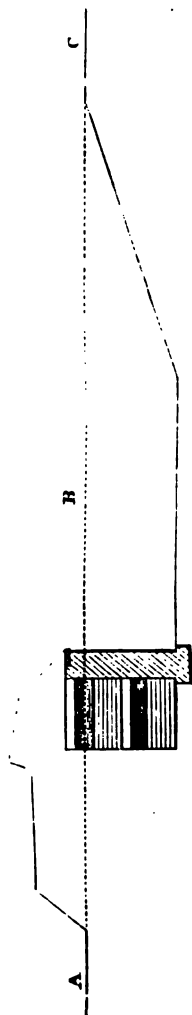


Fig. 3.

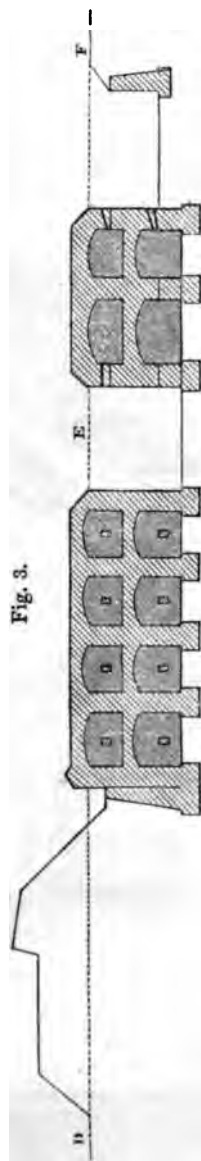
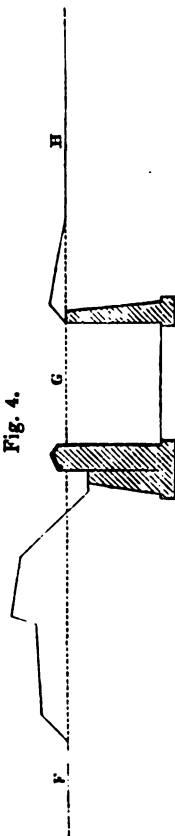


Fig. 4.



144. The fortifications of Cologne consist of about twenty small bastions of earth, with curtains; the whole, and also the counterscarps of the ditches, unrevetted. The works are disposed on a semicircular arc, the Rhine being a diameter. Within the rampart is a loopholed wall, also in the form of a semicircle, enclosing the town. Eleven redoubts, in the form of lunettes, with casemated keeps at their gorges, are disposed about the place, at 500 yards from the ramparts. The faces and flanks of these lunettes are about 75 yards long, and in the central tower of each are mounted 14 or 15 pieces of artillery, partly on an upper terreplein, and partly in casemates: there is, besides, a lower tier of vaults, from which the foot of the keep may be defended by musketry. The ramparts, which are of earth, have considerable relief, and are protected against ricochet fire by vaulted traverses, near each shoulder angle.

The salient angle of each work is, besides, provided with a small cavalier, whose crest is above three feet higher than that of the adjacent faces; the flanks extend across the terreplein, and thus the cavalier constitutes an efficient traverse for the faces of the lunette.

On the opposite side of the Rhine, and covering the bridge, are the fortifications of Deutz, consisting of bastions, which are connected together by curtains, broken outwards, so that the bastions appear to be in re-entering angles.

The figures on the opposite page, 136, represent the plan, with sections, of a detached redoubt at Deutz. Fig. 1 is a general plan of the work, with a casemated réduit, of a semicircular form, at its gorge; fig. 2 represents a longitudinal section through the caponnière, across the ditch at its salient angle, in the direction EF (fig. 1); fig. 3 is a section of the vaulted traverse at CD, which serves to defend the collateral works by a flanking fire, and protect the flank from being enfiladed; and fig. 4 is a section, taken in the direction AB (fig. 1), through the vaulted passage leading from the interior of the work to the countermines under the glacis.

145. The fortifications of Mayence, on the Rhine, consist of a bastioned enceinte, with counterguards before the bastions, a covered way, and two lines of detached redoubts. On the northern side, the covered way is double; and beyond these, on the Harde-Berg plateau, are two strong, polygonal redoubts—these are without flanks, and have keeps, or réduits, in their interiors. Loopholed galleries are formed behind the scarps, on the contour of the work; and, about the angles, there are loopholed vaults in the counterscarps. Shell-proof casemated caponnières are also formed across the ditches; and by the fire of musketry from these, as well as from the counterscarp vaults, the ditches are to be defended.

Two islands below the town are defended by works with open gorges, their salients being towards the north. The bridge of boats over the Rhine is covered by a grand tête-de-pont, formed on a hexagon, and with bastions at the angles. This is called the *Kastel*; its fronts are protected by advanced lunettes and a double covered way. The gorge of this fort is closed by a loopholed wall, formed *en crémaillère*, which connects the extremities of the work with a great casemated barrack, covering the head of the bridge. Lastly, the gorge of the city, along the river, is strengthened by five great casemated batteries, which would secure the city against any attempt to surprise it on that side. (*Maurice, 'Études sur les Places de Mayence et Ulm,' p. 3.*)

The author just quoted observes (p. 39), that, if three or four bastioned forts, with revetments of masonry, well defiladed, and provided with good réduits in the gorges, had been constructed, at distances of 1200 yards from each other, so that they might mutually support one another, they would have covered the western side of Mayence more effectually than the eight small works which have been constructed there. It is true that this would have required a renunciation of the system of detached scarps, casemated redoubts, and counter-sloping glacis, and the adoption of an improved bastion system: this, however, the German engineers appear to have declined.

146. The fortifications of Ulm were undertaken by the Germanic Confederation, with the view of rendering the place a sort of retrenched camp for a numerous army. The works consist of a continuous enceinte, on the left bank of the Danube; with six detached forts, and a strong tête-de-pont, on the right bank.

On the western side, the enceinte consists of a rampart with a scarp half-detached: it is formed *en crémaillère* along the slopes of the Michelsberg, and a stream in front serves as a ditch. Towards the east, the enceinte is constituted by four sides of a polygon, with ditches in front, and it has caponnières at the angles: the counterscarp is reveted.

The tête-de-pont is a crown-work, having four fronts, each of which is above 600 yards long. The salient angles of the polygon, or of the bastions, are occupied by shell-proof casemated batteries. The scarp is half-detached, and provided with loopholes for musketry; it protects a *chemin des rondes* about 6 feet wide. The curtains are broken so as to form a re-entering angle near each flank of the bastion, for the purpose of flanking a casemated caponnière which projects from the central part. ('Etudes sur les Places de Mayence et d'Ulm, par Le Baron Maurice,' pp. 45 et seq.)

147. The town of Rastadt, in the Grand Duchy of Baden, has been fortified according to plans determined on by a committee of engineers. It is situated at the junction of the roads from Kehl, Baden, and Murgthal; and, within 120 yards from the foot of its glacis, passes the railway from Carlsruhe to Strasburg: thus closing the avenues from France to Lower Germany. (See p. 141, overleaf.)

The enceinte is divided into three parts, designated *upper*, *middle*, and *lower* enceintes: these consist of wide bastions with orillons and retired flanks—the latter being in two stages. In the two first parts of the enceinte a high casemated tower, *a*, *c*, in the form of a horse-shoe, occupies the central part of each bastion, and is connected with the orillons by a loopholed wall. The curtain, *d*, *e*, *f*, between two bastions is broken outwards,

and a loopholed wall, at 30 feet from the interior side of the rampart, extends along the whole enceinte. This wall is intended to serve as a defence against the town, in the event of the enemy penetrating into it at some point.

Three strong forts are formed on the enceinte : one of these (L), named Fort Leopold, is situated between the roads leading to Murgthal and Kehl. Its front consists of four bastions, besides a demibastion at each extremity. No curtain, properly speaking, exists, but the nearest flanks of two bastions meet, at right angles to one another, in a re-entering space ; and this is protected by a casemated building, forming a sort of lower flank. A casemated caponnière is placed before the salient angle of each alternate bastion, for the defence of the main ditch ; and in the re-entering angles of the covered way are semicircular réduits casemated. A caponnière, near B, on the left of the fort, is covered by a ravelin, to which it serves as a réduit ; and two detached redoubts, or lunettes, *g*, *h*, are formed about 300 yards beyond the foot of the glacis. At the gorge of the fort is a strong casemated redoubt, *k*, of a semicircular form : it is surrounded by a glacis, and is intended to serve as a réduit for the garrison of the fort. The gorge of the fort is closed by loopholed buildings.

A second work, nearly similar to Fort Leopold, is formed at M, where the road to Carlsruhe leaves Rastadt. A polygonal redoubt, *m*, has been formed beyond the left bastion of the work ; and, at 1000 yards from the right bastion, some high ground has been occupied by two similar redoubts. In front of the lower enceinte there are four other polygonal redoubts, *n*, *p*, *q*, *r*, two of which, *p* and *q*, are connected by a broken curtain : these works cover a piece of ground which, being protected also by one side of the river, may become the site of an entrenched camp.

The third fort, between the middle and lower enceinte, consists of a bastioned front, with a curtain broken outwards, at the angle of which is a casemated traverse, N : within this is a second front, at the extremities of which



are semicircular works casemated ; and a loopholed wall extends by the side of the river, along the gorge of the fort. The front is protected by a double glacis, within the exterior of which are two advanced lunettes, *t* and *v*. The ground before this fort can be inundated, and three redoubts, *w*, *x*, *y*, on the Mühlbach defend the approaches towards this side of the town.

The towers at the gorges of all the works are capable of containing 600 men in each ; and they have two tiers of casemates for artillery.

148. Germersheim, on the Rhine, with respect to its fortifications, nearly resembles Fort Alexander at Coblenz : the ditches being defended by casemated caponnières in the centre of each front ; but the flanks of these casemates are continued towards the rear, till they join the rampart of the enceinte. At the angle of the polygon is a pentagonal area, which is protected by a covering wall in the continuation of the scarp : this wall forms two of the sides ; and in the remaining three, which are formed by brizures of the rampart, are five casemates for mortars. (See fig. 1, p. 134.)

Behind the scarp revetment are numerous discharging-vaults forming casemates : these are constructed in two tiers, and the front wall is pierced with loopholes, from which a fire of musketry may be directed into the main ditch. (See fig. 2, p. 135.)

Passages leading into the casemates, and protected by traverses, are formed along the capitals of the polygon, and near the re-entering brizures of the enceinte : these last passages, which are open above, serve as ditches separating the casemates on opposite sides of them. These passages are not shown in the plan fig. 1, p. 134.

149. At Ingoldstadt, in Bavaria, the fortifications are constructed on principles similar to those which have been above described. On some of the fronts, the enceinte is a rampart coinciding with a side of a polygon ; on others, the rampart has the bastion form, with short flanks and a broken curtain. A large ravelin is constructed before the middle of each front ; and at its gorge is a casemated keep of masonry, which, towards

the rear, extends to the interior of the enceinte. The works have a covered way and glacis in front.

150. Thus, with considerable variations in the details, the fortifications of Western Germany, Prussia, and Bavaria have nearly the same character. In the Austrian dominions, however, the new principles have not been so generally adopted.

The town of Lintz, on the Danube, is fortified with bastions in the usual manner; and on the northern side is a strong fortress, which serves as a citadel to the place. But the town is surrounded, at the distance of about half a mile from the enceinte, by a chain of isolated redoubts, thirty-two in number, called Maximilian Towers. These are circular buildings, whose diameter at the base is 118 feet, and at the top 110 feet; their height is 33 feet, and the mean thickness of the walls is 6 feet 6 inches. They are not, on an average, more than 500 or 600 yards asunder, and occupy the summits of the hills about the town.

Each tower has three floors, of which two are below ground, and the lowest is used as a magazine for stores: its covering vault is shell-proof. The second floor is covered by strong beams of timber, and is lighted by windows: it serves to lodge the garrison, contains kitchens, &c. The upper floor carries a roof, supported on piers, and forms one large casemate. The scarp is pierced with embrasures, and there are two howitzers on light carriages, which can be moved from one part of the circumference to another. The howitzers fire *à ricochet* over the glacis towards the exterior; but towards the town, where there is no glacis, they fire directly on the ground. On the upper stage of each tower, over the shell-proof vaults, there is a battery of eleven 24-pounders, with a parapet 33 feet thick towards the exterior ground, and 10 feet thick towards the town. Within the parapet is a circular platform, consisting of three courses of heavy timber; and, in case of necessity, all the eleven guns can be brought to bear upon one point: but, while loading or sponging, the men stand upon the platform, and are exposed above the

parapet. In the event of a war, the towers are to be united by a palisaded covered way. The subjoined figures represent part of the upper platform, and of the casemates below (fig. 1), with a vertical section (fig. 2) through one of the towers.

Fig. 1.

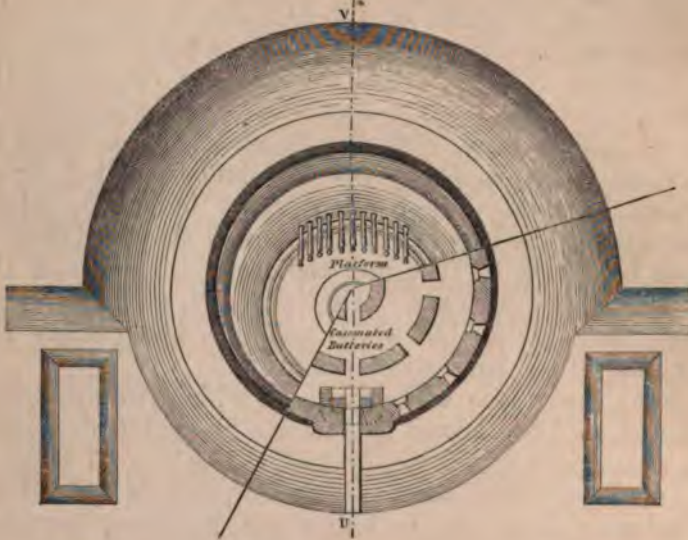


Fig. 2.



151. In order to judge of the degree of resistance which these works would offer, in the event of being attacked with artillery, one of them was subjected during five hours to the action of a battery armed with guns, mortars, and Congreve rockets. At the end of

that time, the gun-carriages on the tower were destroyed, the platform was crushed, and the whole battery of the tower rendered unserviceable; two of the rockets had even penetrated into the upper casemate. The engineers, who represented the defenders, employed the succeeding night in repairing the damaged parapet and the platform, and in replacing the broken gun-carriages by others: they were then allowed to keep up a fire during five hours against the battery of the besiegers, by which it is said they seriously damaged the battery. The result of the experiment, however, appears to be in favour of the besiegers, since it is proved that the defences of the tower were quickly destroyed, even by the fire from one battery. What, then, would have been the consequence, if two or three batteries had been opened against the tower? It is true that the damage which the tower sustained in this experiment was soon repaired; but, in actual warfare, would the defenders have had the men and the means necessary to effect the repairs? This is very doubtful; and, if an attack were made on the intrenched camp after the fire of the tower was silenced, the work could offer no obstacle to its success.

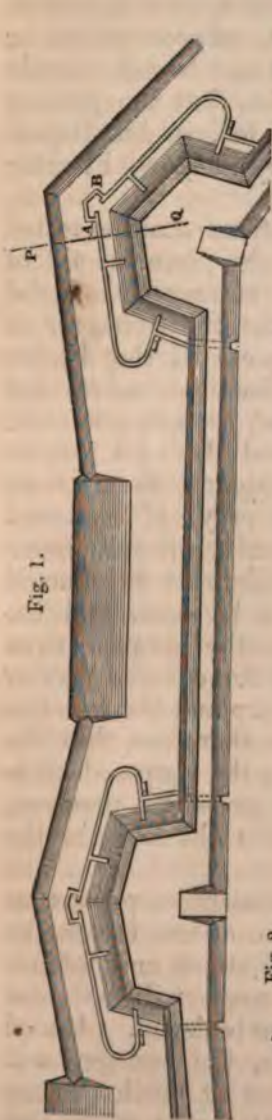
It is easy to perceive that the system of detached circular towers about a place would possess but feeble defensive qualities. The taking of one of the towers, against which a very superior fire of artillery might be directed, would present few difficulties; after which the adjacent towers, attacked in flank and at the gorge, would presently fall, since their greatest powers of defence are on the side towards the country. Perhaps even, they might be carried immediately by escalade, or entered by bags of powder being applied to the gates and exploded. These operations, if executed by night, would be attended with little danger, since there exist no flanking nor reverse defences; nor are there any machicolations by which the enemy, at the foot of the wall, could be annoyed. (*Mémoire sur la Fortification Polygonale*, pp. 128, 131.)

152. At Verona, the old fortifications have been pre-

served, but the bastions are covered by detached scarps; and before the curtains there is a countersloping glacis. The bastioned fronts are constructed upon exterior sides, from 490 to 540 yards long; and the lengths of the curtains are about 325 yards. The earth composing the rampart and parapet of the curtain is supported by a revetment of masonry as usual; but, on the exterior of the faces and flanks of the bastions, there is a *chemin des rondes* with a detached scarp loopholed, and similar to that of Carnot. At the shoulders of the bastions are formed orillons, which project about 27 yards from the flanks; the wall forming the reverse of the orillon is continued till it meets the exterior slope of the flank; and transverse walls are built at intervals across the *chemin des rondes* before the faces of the bastions. At each angle of the polygon, on the detached scarp, is formed a bastionette, or small casemated bastion, whose faces and flanks are each about 10 yards long: the bastion contains, besides the groundfloor, an upper stage of casemates, loopholed for musketry. Near each orillon two of the vaults on the flank have embrasures, from which the ditch may be defended by grazing fires of artillery. The ditches are about 25 yards broad; the whole counterscarp is of earth; and, except before the curtain, it is formed with a slope whose base is equal to its height. There are no ravelins nor tenailles, nor is there any covered way. There are disposed, however, as detached forts at intervals about the place, circular towers of masonry, corresponding to the Maximilian towers at Lintz, but of more simple construction; and, like those, very liable to be destroyed from afar by the powerful ordnance which may now be brought against them.

In the subjoined cuts, fig. 1 represents a plan of one of the fronts of Verona; fig. 2 is an enlarged plan of the bastionette AB, fig. 1; fig. 3 is a section across a bastion, in the direction PQ, fig. 1; fig. 4 is a plan, and fig. 5 is a half elevation and half section of one of the detached towers protecting the space for an intrenched camp about the town.

A body of troops, sufficient to defend the place, if



drawn from the army in the field, would seriously cripple that army; and without such troops the town would assuredly be taken by assault, as soon as one or two of the towers should be silenced and breaches made in the scarp wall. Little doubt exists that the present Emperor of the French had intended, in his Italian campaign (1859), to attempt to carry the town by main force.

153. When these novel constructions shall be tested in a regular siege, carried on with the powerful aid of modern artillery, it will be found, as may be inferred from what has been described in the third chapter of this work, that the masonry defences in the ditches which are substitutes for the flanks of bastions, and reveted scarps, will be destroyed from afar, though not seen. No masonry defences can withstand the vast powers which modern artillery will bring against them in all future sieges, and earthen works only, of increased thickness, can withstand the destructive effects of such artillery. All ramparts must therefore be constructed of earth as far down as they can be seen, and the masonry defences must be formed in the rampart, so as to rise no higher than the crest of the covered way or other outwork: thus leaving the scarp and the counter-scarp only of masonry. It appears therefore, that the modern artillery, far from justifying the proposed alterations in the conformation of ramparts and parapets, will render it necessary to retain the old form in the profiles of fortifications.

154. Untried in war, we cannot venture to pronounce with any certainty as to the relative effects which the new rifle-cannon will produce on the attack and defence of fortresses, and whether that change will be most favourable to the besiegers or to the besieged. Armed with these new and powerful means, the besieger will be enabled to establish his batteries at much greater distances than before, even at 1200 yards: where, by their fire being concentrated on the point of attack, they will be more efficient in ruining the parapets, silencing the fire from thence, and breaching the ram-

parts, while their fire cannot, any more than at present, be successfully opposed by that of the defenders.

It is supposed that the besieger, being obliged to carry on the operations of the attack over such an extent of ground, will find his labour greatly increased, and much loss of time incurred; but this supposition is unfounded. The besieger's first batteries must, no doubt, be executed at a great distance from the fortress: but the operation of breaking ground, to form the first parallel and the approaches beyond it, can be executed by night under the protection of those batteries at the usual distance, 600 yards; and, from these, the new rifle-muskets will have a deadly effect on the gunners of the place, unless they are well protected by musket-proof mantelets or screens.

155. The following observations may serve to show that, if all the objectionable points in the polygonal system of fortification were removed, that system would still possess no advantages over the bastion system; for, without departing in the least from the spirit of the rules delivered in the school of Vauban, the bastion trace may be so modified as to obviate all the defects which, by the adoption of the polygonal trace, it is proposed to remedy.

When an extensive city is to be fortified, the angles of the polygon supposed to be formed on its perimeter are not much less than two right angles; and if, on such a polygon, bastions are traced according to Vauban's principles,—the perpendicular (technically so called) being about equal in length to the flanks of the bastions, or to the breadth of the main ditch,—the lines of defence, or the faces of the bastions, would form with one another an angle so obtuse that their prolongations towards the exterior would fall within the ravelins or other outworks, however small, between the bastions: consequently, those faces, though rectilinear, could not be ricoched; and—each flank being, by supposition, perpendicular, as usual, to the face which its fire is to graze—the ditch before such face would be effectually defended by a flank of a collateral bastion. The advo-

cates of the polygonal system give to the main ditch a greater breadth (50 yards) than is usually assigned to it in the constructions of Vauban; and this is highly advantageous, since it allows each flank of a bastion to receive as many as eleven guns, in one tier.

The length of the front of fortification, conformably to the principles of the French school,—being determined with reference to the range of the arms employed in the defence,—was, in the time of Vauban, necessarily limited to about 400 yards; but the superior range of the present arms, both great and small, will permit the length of a front to be as much as 1000 yards. This length may therefore be given to each side of the polygon of fortification: but, neither in this, nor in the great breadth of the main ditch, is there any departure from the spirit of the systems of Vauban and Cormontaigne. If, then, as in the French school, the faces of the bastions were made equal in extent to one-third of the whole front, the gorge of the bastion would be of such extent, that double, and even triple flanks, as in Count Pagan's system, might be formed: so as to afford room for any quantity of artillery that might be desired for the defence of the ditch; while the interior of the bastion would be sufficiently capacious to admit of the movements of the defenders being made with freedom, or strong retrenchments being formed in it. The artillery on the flanks of the bastions should be in shell-proof casemates: such as those proposed by Bousmard, and executed by Chasseloup de Labat, in the flanks of the *tenailles*. And thus it may be said, in a word, that the bastion system, with the long-range musketry of the present day, affords, in as great a degree as the polygonal system, protection from *ricochet* and *pitching* fire, and ample means for the defence of the main ditch.

The very salient ravelins first proposed by Cormontaigne, and adopted by Carnot, were indeed objectionable in one respect, since the acuteness of their salient angles rendered their long faces very liable to be ricoched, unless protected by traverses: nevertheless, the engineers of the polygonal school of fortification

have, in several instances, retained them; only endeavouring to protect a part of each face from ricochet fire, by raising the parapet about the salient angle higher than the rest, as had been before proposed by Bousmard. But the French engineers of the more recent school have ceased to recommend the construction of very salient ravelins, and have proposed to substitute for them strong forts detached, in advance of the enceinte; and forts so detached have, with great propriety, been generally adopted by the Austrian and Prussian engineers.

156. The fortifications of Sevastopol may be said to have been executed, in part, on the principles of the modern German school: the branches of the rampart being disposed so that few of them could be enfiladed by the besiegers; and the long duration of the siege of that place has been ascribed to this departure from the method of Vauban. That fortress, however, derived great part of its strength from the existence of the Mamelon Fort in front, and the redoubts on Mount Sapone, which took the trenches of the besiegers in flank. The Great Redan and the Malakoff Tower may even be considered as bastions commanding by their fire the ground on which the approaches of the besiegers were carried on. The great resistance of the place was rather due to the rocky nature of the ground before the works—which impeded the excavation of the trenches of attack—and to the superiority of the Russian artillery fire in the early time of the siege; as the final reduction was due to the overwhelming fire of the allied artillery, near its termination, by which the ramparts of the place were destroyed, and the blindages of the besiegers were eventually crushed. Had the Malakoff Tower been a bastion à la Vauban with a retrenchment at its gorge in the form of a small front of fortification—instead of being an entirely closed work, having its interior choked with traverses which deprived the defenders of the power of acting offensively—it may be doubted whether or not Marshal Pélissier would have succeeded in that gallant assault by which at length the enemy

was compelled to retire from the south side of the harbour. The south side of the town was fortified with bastions; and it deserves to be remarked, that, on account of the strength of the works, the attack on this side was abandoned.

157. In 1849, an English gentleman, Mr. James Fergusson, made public 'An Essay on a Proposed New System of Fortification,' in which an effort is made to prove that the bastion system is founded on a mistake; and a superiority, for that which is proposed, is claimed, in conformity with the ideas of Montalembert (See art. 134 of this work), on the ground, chiefly, that it permits so great an amount of artillery fire to be made to bear, from the ramparts, on any spot which can be occupied by the besiegers, as to overpower entirely all that can be brought against it. As the system has excited considerable notice, it may be proper here to give an outline of it, as it was originally described by its author, with a brief notice of the observations which have been made on it by British engineers.

The enceinte is described as a circular redoubt, consisting of four ramparts of earth disposed in terraces, one above another; the mean diameter, or the diameter of a circle passing through the centre of gravity in a vertical section of all the ramparts, being 633 yards, and the circumference of the circle 2000 yards. The crest of the higher, or inner parapet, is 50 feet; and the lower, or the fourth, 10 feet, above the level of the natural ground; and the horizontal breadth of the space occupied by all the four ramparts is about 400 feet. Guns may be mounted, in casemates or otherwise, on any part of these ramparts, and traverses cross the terrepleins at intervals.

On the exterior of these is a *fausse-braye*, or fifth rampart, the crest of whose parapet is on the level of the natural ground; the ditch is 60 feet deep, and its width must necessarily be about 200 feet. Beyond this, is a covered way and glacis; and in the former are numerous *réduits* of earth, in the form of circular segments; the crest of the glacis is a waving line, conformable to the curves of the *réduits*. In these *réduits*, and in the

form of the glacis, it resembles a system of fortification proposed a few years since by the late Professor Bordwine of Addiscombe.

Mr. Fergusson has adopted the idea of his circular enceinte from M. Carnot's '*Mémoire sur la Fortification Primitive*,' which was published in 1823, and in which he, Carnot, proposes to abandon the bastioned enceinte, on the ground that works intended to flank an enemy cannot be constructed without being exposed, by that very disposition, to be flanked in turn (art. 72); and that the importance of flanking defence has vanished since the employment of heavy breaching artillery in the attack of fortresses. Mr. Fergusson, however, being conscious of the importance of having a flanking defence for the face of a rampart, when the enemy has arrived at its foot, has constructed projecting works, forming a kind of bastions, in the parapet of the *fausse-braye*: each face and flank of these works is a curve of contrary flexure, the two curves meeting in a convex cusp at the salient angle. The centres of the bastions are at the angles of a regular octagon, which may be supposed to surround the enceinte.

The parapet next above the *fausse-braye* may have similar projections above the *terrepleins* of the former, so as to become a species of cavaliers; and the guns in them, as well as in the projections below, may be placed in casemates: thus the ditch is defended by two tiers of guns. The flanks of the collateral projections are connected by a detached loopholed wall, as in the system of Carnot, in the form of a segment of a circle.

Mr. Fergusson proposed to arm the four ramparts with 1000 guns, but he observes that double that number may be mounted on them, if necessary: of these, one-fourth may be 8-inch shell guns, one fourth 32-pounders, and the rest may be 24-pounders.

Besides the power of opposing to the batteries of the besiegers a superior fire of artillery, Mr. Fergusson considers that his ramparts, from their circular form, are not liable to be ricoched; and the casemated works below the level of the ground would undoubtedly, if

they could be preserved entire till near the end of the siege, present very serious obstacles to an enemy in his attempt to pass the ditch. It is admitted that, when the curvilinear form is adopted for the rampart of an enceinte, if the radius of curvature is 5000 or 6000 yards, the liability of the rampart to be enfiladed is as great as if it were a straight line; and the projector limits the application of his system to the construction of circular forts whose radii are 1200 or 1500 yards only. He therefore plainly intends that his system should be applied in the construction of citadels, or of the detached works which may be formed about a fortified town, at considerable distances from it, for the purpose of protecting an army which may have been compelled to retire before a superior force: there to wait in security the arrival of reinforcements, in order to enable it, with increased means, again to oppose the enemy in the field.

158. Mr. Fergusson imagines that, by the superiority of his artillery, he can reverse the military maxim hitherto received, and render the powers of defence superior to those of the attack. His argument is, that, in the attack of a place fortified with bastions, the besieger may select a spot for a battery, suppose of ten guns, where only one gun in the fortress can reply to it; while, in his system, he can always bring ten, or even a greater number, to oppose such a battery. The supposition is, however, not fair; for, in a fortification with bastions, there is no place—even if it were directly in face of the most acute salient angle of a bastion or ravelin—where the battery would not be replied to by at least three guns in the short face formed perpendicularly to the capital at that angle, besides all the guns on the nearest faces of the collateral works. Mr. Fergusson dwells with justice on the advantage which ramparts of earth have over those of masonry, in resisting the crushing effects of the heavy artillery in use at present; and this is sufficiently evident from the speedy destruction of the masonry defences at Bomarsund in 1854, compared with the protracted resistance made by Silistria and Sevastopol, in consequence of

the works being constructed of earth. The principle has, indeed, been recognised and acted on both by British and foreign engineers.

159. With respect to the presumed superiority of the number of guns in the fort, to the number which the besiegers can place in battery against it, it may safely be presumed that the besiegers of a fortified place will always have the power of bringing up any quantity of artillery which they may require; and it is suggested by a distinguished engineer, Lieut.-Col. Jebb, ('Flying Shots at Fergusson,' page 17), that this may be mounted in sunken batteries, placed at any convenient distances from one another, laterally, and also one behind another in the direction of a radius of the fort, produced; these may be five feet deep, and have low parapets or none, so that the guns would be little exposed to the fire from the place, and consequently the batteries may be executed with as little difficulty as the ordinary batteries in the first parallel of a place fortified on the bastion system. Only five or six guns in each tier of the fort can see the approaches without destroying their own merlons; while the fort presents itself, like a great target, to the concentrated fire of all the guns in these batteries of attack.

Hence, the shot or shells from mortars or 8-inch howitzers, fired directly against the fortress, would effectually ruin the parapets and silence the fire from them, exactly as a few shot fired from a Martello tower are found to oppose successfully the fire of the broadside battery of a ship of the line.

It is evident, moreover, that, within an extent of above 100 yards, the curvature of the ramparts is so small, that these might be nearly as effectually enfiladed as if they were formed on straight lines. If, therefore, a parallel trench were executed during the first night of a siege, at the distance of about 500 yards from the covered way, and were extended to meet a tangent drawn to one of the circular parapets, at each end of a portion of the circumference, equal to about 100 yards in length; batteries of 8 or 10-inch howitzers, similar to the former, sunk at the extremities of such parallel,

might be used to batter, by direct fire, the extremities of that portion of the circumference, and ricochet by enfilade, at elevations of eight or ten degrees, the portion itself. The effect of this would be to ruin the parapets and dismount the guns: no traverses would secure these, for, among so many, shot or shells which might miss one, would almost certainly strike another. The shot or shells would, at the same time, crush the roofs of the casemates in the ditch, or breach the walls; and thus expose the place to the risk of a sudden and general assault.

160. When we come to the details of Mr. Fergusson's construction, we find that he lays great stress on having a scarp-wall about his fortress, which wall he would have from 30 to 50 feet high above the bottom of the ditch, with its cordon 20 or 30 feet below the level of the neighbouring country; consequently his ditches, supposed to be dry, cannot be less than 70 or 80 feet deep. He conceives that shot, pitched into a ditch from a battery at the distance of 1500 or 2000 yards, would produce little effect upon such a wall, or upon casemates of masonry in the ditch: this conception, however, is sufficiently proved to be ill-founded by what has been said (arts. 119 et seq.) about the effect of pitching-fire; and as the momentum of falling shot is greatly increased by the distance which the shot has to descend vertically, in falling on the object, the shot from guns so elevated that the descending branch of their trajectory may pass over a glacis or counterguard before arriving at such casemate or wall, must inevitably crush any masonry works in the ditch, however solidly they may be constructed.

161. Mr. Fergusson imagines that shells thrown from the besiegers' batteries upwards, from the low level of those batteries, would fall so obliquely upon the earthen slopes of the fort, that they would glance, or be reflected, upwards, and thus cause very little rubbish to fall upon the defenders of the works below them. To this it may be replied, that the besiegers would soon find the angle of elevation that should be given to their

artillery, in order that the shot in its descent may fall nearly perpendicularly on the slopes; the shells would then bury themselves in the earth, and, by exploding, smother the workmen employed in repairing the parapets, or the defenders serving the guns below, unless protected by massive blindages.

Mr. Fergusson lays stress upon the power which he has, in his system, of placing his artillery and men wherever they may be wanted at any given time, at such distances from one another that a great number need not at once be exposed to a concentrated fire. He considers that, if even the ramparts were ruined by the besiegers, the defenders would still have it in their power to construct batteries on the ruins: it may be answered that they might, indeed, attempt this by night, but the works would infallibly be destroyed as soon as they were formed.

162. Mr. Fergusson proposes no outworks—such as ravelins, for example; and he asserts that they do not retard the taking of a place for one hour. The assertion is applicable to the small ravelins of Vauban only, which may indeed be breached and taken at the same time as the bastions are breached and attacked; but it does not apply, by any means, to the salient ravelins of Cormontaigne and the later French engineers, which must be taken some days before the approaches of the besiegers can arrive at the counterscarp of the main ditch. Mr. Fergusson thus deprives himself of an important advantage, apparently in order to save the expense of constructing such works. Detached forts he rightly considers as highly important, and therefore he proposes to adopt them extensively.

163. The garrisons of Mr. Fergusson's works are to be lodged in casemates, which he would form in the inner ramparts: such casemates would have to be built up from the level of the ground, and consequently would be constructed at vast expense; and, as these would be liable to injury from shells falling into the interior of the work, it is admitted that it would be necessary to incur the additional expense of constructing

masks for their protection. Mr. Fergusson advocates a detached wall in the ditch, precisely for the reasons alleged by Carnot (art. 71, note) in its favour: this wall is of a curvilinear form, between the caponnières or projecting works, in the ditch; and he proposes to flank or defend it in a manner which was proposed by Bousmard for defending the curvilinear faces of his bastions, by disposing the axes of the guns in the flanking casemates so that the lines of fire might be in the directions of tangents to different points on the wall—a method far less perfect than that of grazing by fire the front of a wall formed in a straight line.

The great width and depth of the ditch is a manifest disadvantage, as it would almost entirely prevent the defenders from making sorties.

164. It may be observed, that redoubts of a circular figure are seldom used for field fortifications, on account of the unsuitable nature of their outline to the ground on which they are to be constructed, which ought to be a level plain or a hill of a conical form; and from the impossibility of having a flanking defence for their ditches. The same remark holds good in permanent fortification, and it may be applied to the circular fort proposed by Mr. Fergusson. From the earliest times to the present, the improvements aimed at in fortification have been arrived at by abandoning the circular outline. The round towers of the ancients, which were placed at certain distances from one another on the enceinte, gave place to square towers, having one of the angles in front, and this led gradually to the adoption of bastions. Circular orillons and concave flanks have fallen into disuse, and the small half-moon, as it was called, has long since been exchanged for a large projecting ravelin; and, since circular constructions, whether as the enceintes or the outworks of a fortress, never can be completely flanked, a return to such forms cannot but be considered as a retrograde step in military science.

In the attack of a circular fort, it may be assumed that the second parallel would be completed, and the batteries opened in it, on the eighth day: the approaches

being protected by the batteries in the first parallel. And when it is considered that, in good soil, men, who are excavating the trenches of attack, can cover themselves in half an hour, two days more would be sufficient for advancing to the crest of the glacis, for the purpose of dismantling the caponnières—if this has not already been done by the fire of the batteries already executed—and protecting the passage of the ditch. The works still existing in the ditch now become powerless, and may be destroyed by the plunging fire to which they would be exposed.

165. In his more recent publications, Mr. Fergusson has greatly modified his first idea, and we find that his project for fortifying places is founded entirely on the principle, that the enceinte shall be effectually defended by flanking fire. But, while approving of this return to a sound principle, we cannot but observe that the ends proposed would be gained in an equal, and even a higher degree, if the fortification were on the bastion trace. In a lecture delivered by Mr. Fergusson, April 27th of the present year (1859), at which Major-General Sir William Fenwick Williams presided, and in his replies on the occasion to the observations made by the President, by Colonel Sir Frederick Abbott, Major Ward, and Captains Tyler and Crossman, R.E., that gentleman admitted, that the interior of his fort would not be sufficiently capacious to allow the garrison required to man it to be entirely lodged in its casemates; and he explained his assumption to be, that the work would be manned and armed, only in proportion to the force in men and artillery which the enemy might bring against it.

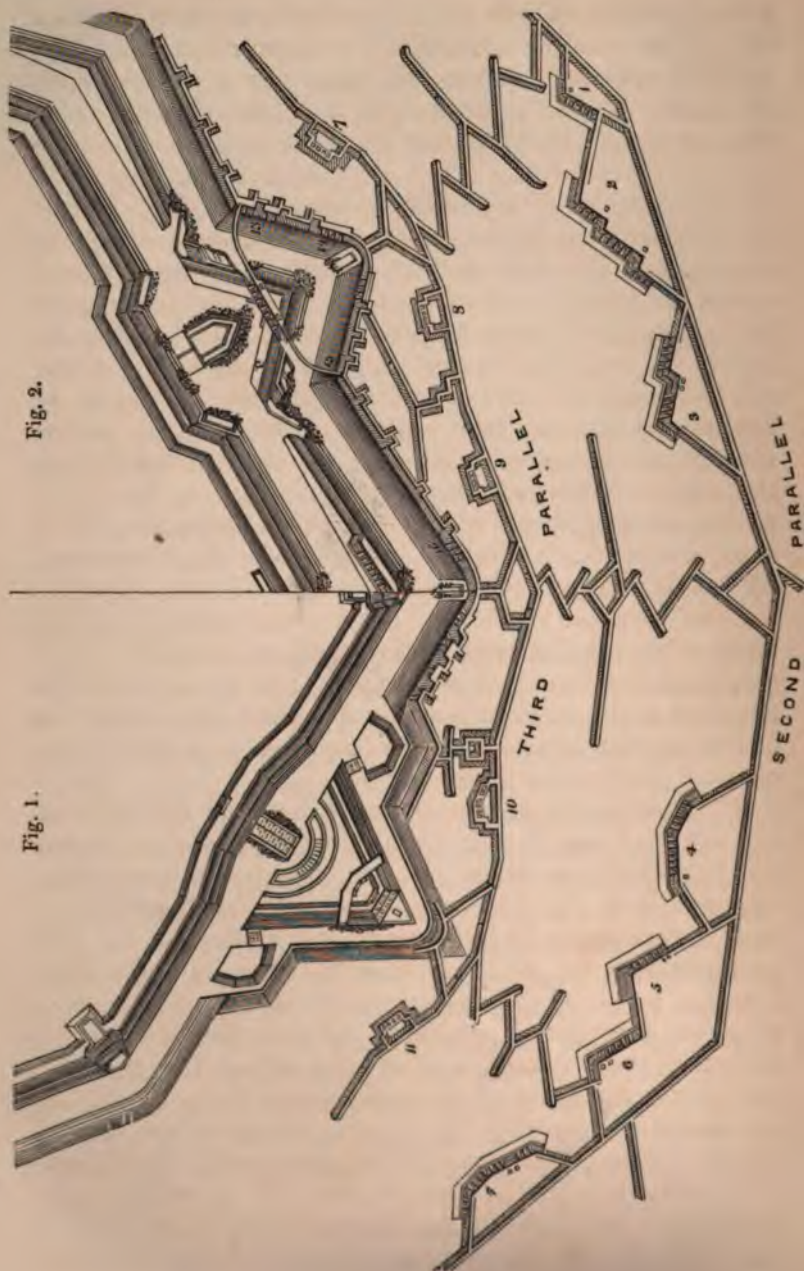
Mr. Fergusson did not deny that the great height of its rampart exposed the guns in them more effectually to the fire of the besiegers' batteries on the exterior ground, than these last would be to the fire from the fort. He also assented to the truth of an observation made by Sir Frederick Abbott, that his system is really only the bastion system, carried out by having a great rampart behind the enceinte, for its support or protection.

But an important fact is that, as the flanking casemates of the work are liable to be destroyed by the distant fire of the besiegers' batteries, there will be no more difficulty in this system than in any other, to breach the scarp, or protecting wall, in the ditch, and take the fort by assault.

166. With respect to fortifications of a kind similar to those which have been described as prevalent in Western Germany, it is evident that, in besieging a place so fortified, the first operations must be carried on in the usual manner. The besiegers have, in fact, nothing to apprehend from the casemates of the scarp, or those in the ditches; for, being masked by the works in their front, they can have no effect upon the approaches, till these arrive at the crest of the glacis. It is only by the fire of artillery mounted on the ramparts as usual, that the works of the besiegers can be opposed; and the effect of this, in the modern constructions, can be no greater than it would be in the bastion system.

It may be remarked, that the increase of labour required for the operations of the attack, on account of several fronts of the polygon being nearly in a straight line, is felt only in the extent of the principal parallels, which must be rather greater than would be necessary for a fortification with bastions, on an inferior polygon: but this augmentation need not exceed 800 yards for the second parallel, and 150 for the third; and it would not retard, by more than a day, the progress of the attack. The second parallel, traced at 300 yards from the most advanced salients of the place, may therefore be commenced on the third night, and finished on the fourth. On the fourth day, the batteries for direct and ricochet fire may be traced: the garrison not being able to oppose their construction by any but the ordinary means, these batteries may be finished in thirty-six hours, and may commence firing on the morning of the sixth day.

The cut on p. 162 represents the processes of attack on two fronts of fortification, traced agreeably to the



polygonal system. In fig. 1, the enceinte is strengthened by a large ravelin, and in fig. 2 by counterscarps. The lines of approach are nearly alike for both fronts, as far as the crowning of the glacis before the angles of the polygon. Here batteries are constructed to breach the caponnière in the main ditch of fig. 1, or complete its destruction, if this has been already in part effected by the more distant batteries; also to destroy the casemates near P, which defend the ditch of the counterscarp in fig. 2. Batteries are formed on the crest of the glacis, before the salient angle of the ravelin in fig. 1, in order to breach it, and on the crest of the glacis before the two flanking redoubts in the same figure, to destroy the casemates in those works. Breaching and counter batteries are also formed before the salient angle of the ravelin in fig. 2, in order to breach that work and destroy the casemates which should defend its ditch. After this a lodgment may be made within the salient angle of the ravelin, for the purpose of breaching the caponnière in the main ditch, and silencing the artillery or musketry in the short flanks of the enceinte. The construction of the batteries presents nothing peculiar, and it may be observed that no batteries are required to ricochet the covered way, since there is none.

The batteries intended to act by vertical fire against the caponnières in the ditches, may be distant about 600 yards from those works, which is about the range of heavy artillery; or they may be formed at a less distance, as in the positions indicated by the numbers 1, 2, &c., to 7, in the second parallel.—See figs. 1 and 2, p. 162. Now, supposing the *line of aim* on a piece of battering ordnance to be directed to an object at that distance, the shot, after leaving the gun in the direction of the axis of the bore, would, in its descent, cross the line of aim at the place of the object: hence, if, between the gun and the object, any work, as a glacis, were interposed—provided such work were not higher than the trajectory of the shot—the effect of the shot on the object would be the same

as if no work intervened. But, at 600 yards, the 18 and 24-pounder shot penetrate from 12 to 16 inches into masonry; therefore a continuous fire of such ordnance would soon destroy the walls of the caponnières, weakened as they are by the number of embrasures formed in them.

167. This result is so much the more certain, as the main ditch, with the countersloping glacis, being about 50 yards wide, the side walls of a caponnière would be exposed to the fire of 8 or 10 guns: it cannot, therefore, be doubted that the place would be deprived of its flanking defences at an early period of the siege. The ricochet fire from the batteries directly opposed to the rampart of the enceinte will, as before shown, complete the destruction of the caponnières and effectually breach the wall forming the detached scarp; and thus the place will be, at the same time, exposed to the danger of a general assault.

168. Should an assault be postponed, the operations of the besiegers on the ground may still continue as usual. On the fifth and sixth night, some oblique boyeaux may be executed beyond the second parallel; on the seventh night the demi-parallels may be formed; and, advancing from thence in oblique boyeaux, by the ninth night the third parallel may be executed. There being no covered way, all these trenches may be formed by the flying sap.

In the third parallel may be executed mortar batteries, in the positions numbered from 7 to 11, in figs. 1 and 2, p. 162; and from these shells and other missiles may be projected, at considerable elevations, into the ravelins or counterguards.

The absence of a covered way with its protecting parapet, greatly simplifies the operations of the besiegers near the ditches of the place: thus trench cavaliers become unnecessary; and, by working on one side only of the capital of the work in front, the labour of a double sap is avoided. If, however, this operation should appear too hazardous, the approaches may be carried on as usual, setting out from the third

parallel, and, on the tenth night, executing a circular portion by full sap. On the following night the besiegers may, by double sap carried on directly to the front, arrive at the rounding of the ditch, before the salient angle of the work attacked: and it is impossible to avoid seeing, that the nonexistence of crossing fires of musketry from a covered way must greatly diminish the time and the danger of executing those operations.

169. The crowning of the counterscarp forms the commencement of a new period of the siege, as it may be expected that it will be opposed by the fire from the loopholes of the scarp wall, and the casemates in the ditch, or from such parts of the wall and casemates as have not been already destroyed.

It should be remarked, that the loop-holes, as well of the detached wall at Coblenz as of the revetments of Germersheim, and also the lower tier of guns in the caponnières, are situated about three feet above the bottom of the ditch; and are therefore on a lower level than the crest of the glacis, which is high enough to cover the whole scarp. It follows, that the lines of fire proceeding from the detached wall, and likewise from the lower tier of guns in the caponnières, will necessarily pass over that crest in an ascending direction; but the glacis having a descent towards the country (see that which is before the ravelin in fig. 1, p. 162), it is evident that the gabions which form the crowning lodgment, being on this reverse slope, will be placed without being even seen by the defenders behind the wall. The operation of crowning the glacis will consequently take place without experiencing any annoyance, except from the fire of the parapets of the enceinte and the upper tier of guns in the caponnières; and even this will be at a greater distance than in the bastion system with a covered way.

If, however, the formation of the counterbatteries by the usual methods should appear too dangerous, it would not be difficult to imagine that another method could be employed, which should be equally practicable and more rapid. For example, sandbags might be used in

building the merlons between the embrasures ; that part of the work could then be executed in a few minutes : the inner half of the thickness of the merlons could be formed without getting out of the trench, and the remainder by men, standing on the soles of the embrasures, to whom sandbags, gabions, or hurdles might be handed as fast as they could be placed. The work being executed by night, the enemy might not even perceive it.

Breaching batteries will scarcely be necessary, if the rampart is protected only by a detached wall à la Carnot : even if the wall has not been breached at an early period, it may now be destroyed by some of the pieces in the counterbattery. If the scarp is formed, as at Germersheim, by a revetment with discharging arches, breaching batteries will become necessary ; but, for the reason before given, the construction of these cannot be impeded by the fire from the casemates, and they will have to sustain only the fire from the *chemin des rondes*, and from the parapet directly in front of them. Now, such fires have never prevented the formation of breaching batteries against a bastioned front ; and, therefore, they would not prevent the formation in the present case—the reverse fires from the collateral fronts being less effective than they would be in an ordinary front with very salient ravelins.

170. On the thirteenth day of the siege, the counter and breaching batteries may commence firing ; and, on the same day, the crest of the glacis may be crowned in its whole length. The fire from these batteries will soon complete the destruction of the caponnières in the ditches ; and it may then be directed against the réduits in the re-entering angle on each side of a ravelin, as in fig. 1, the flanks of these works being completely exposed. Thus, on the fourteenth day, breaches will be effected at the salient, and perhaps at the shoulder angles ; the caponnières will be destroyed ; and, if the place be protected by a detached revetment, the *chemin des rondes* will permit the assailants to extend themselves in line, and mount the rampart on a wide front. Lastly,

the ravelin will, at the same time, be breached at the salient angle, and immediately attacked. Thus the siege will be terminated, without the besiegers encountering the dangers which result from the slow operations attending the latest operations against a fortress on the bastion system. (*'Mémoire sur la Fortification Polygonale,'* p. 60.)

171. If the ramparts of a place are covered by counter-guards as well as ravelins (as at Fort Alexander, fig. 1, p. 128, and fig. 2, p. 162)—which may be considered as a polygonal enceinte strengthened by counter-guards—the process of the attack, up to the completion of the crowning batteries on the crest of the glacis, may be the same as that which has been already described: the batteries before the salient angles of the counter-guards may then be employed to demolish the casemates before the faces of the collateral ravelins, and to breach the salient angles of the counter-guards; the batteries before the angles of the ravelins may, in like manner, breach those angles, and destroy the casemates which defend the ditches of the works, if none of these effects have been previously produced by fires from the batteries in the second parallel. The detached scarps being ruined at the same time, assaults may be simultaneously made, and lodgments formed, in the usual manner, on the terrepleins of both counter-guards and ravelins.

172. It appears then, that not only may the detached or semidetached scarp be breached and ruined from the first or second parallel; but, moreover, the vast internal defences of masonry, constituting the caponnières in the ditches, and consisting of two or three tiers of fire—resembling, as Bousmard has well said,* (*'Essai Général de Fortification,'* vol. iv. p. 2, édit. 1814) the “sabords et entreponts des vaisseaux de guerre,” upon which the integrity of the place entirely depends—

* “Aussi depuis long-temps, cette démangeaison des systèmes est calmée; et, sans Montalembert et sa manie de transplanter dans la fortification les sabords et les entreponts des vaisseaux de guerre, la dernière moitié de ce siècle se serait écoulée sans avoir produit un seul nouveau système capable de faire la moindre sensation.”

will at an early period of the siege be ruined. At the same time, the faces—as the portions, AQ, RB, of the front of the German system may still be called (see fig. 1, p. 128)—derive no protection whatever from the diminutive flank formed by the brizures. Thus, in abandoning the bastion system, in order to avoid the effects of enfilading and ricochet fire on the enceinte of the place, the German engineers have fallen into the greater evil of the main ditch being without defence, and the place exposed to an assault, as soon as the approaches of the besiegers have advanced, at most, only half-way between the first parallel and the glacis.

In counterbattering the caponnière in the centre of the main ditch of a front of fortification similar to that of Fort Alexander, it will be perceived (on referring to fig. 1, p. 128), that the projectiles have to pass over the crest of a countersloping glacis, covering the angle of the polygon. Also, in counterbattering the casemates which defend the ditches of the ravelin, the projectiles have to pass over the crest of the countersloping glacis, about the salient angle of that work : the crest of the countersloping glacis being 280 yards from the caponnière, and that of the glacis before the ravelin being 170 yards before the casemate. The elevations of the guns need not, therefore, be considerable ; and, consequently, the works may be more effectually counterbattered and ruined, than the detached wall of Carnot was in the experiment at Woolwich in 1824, when the wall was only 20 yards from the crest of the countersloping glacis in its front ; and, consequently, the shot fell very obliquely on the lower part.

173. Some French engineers think that M. Mangin has proscribed rather too absolutely some portions of the new German system ; and they consider that some of the accessory details of that system may, in certain cases and peculiar localities, be adopted with advantage. This is no doubt true ; but the advantage would be rather in the defences of field-works, redoubts and posts against musketry and light field-artillery, than in the

defence of fortresses against cannon—that is, rather in field than in permanent fortification.*

174. Now all French, as well as the best British engineers, and even some Germans, think that the generality of the Prussian and German engineers have committed grievous errors, in combining to such an extent masonry works with ramparts of earth, in the fortresses which they have constructed or remodelled.

Vaults there are, which are capable of resisting the effects of shot or shells fired at great elevations; and they may entirely escape being struck, in such uncertain practice: but no vault is capable of resisting the destructive effects of heavy shot, fired nearly horizontally, which, penetrating the vertical walls, will speedily ruin the strongest buildings.

175. The practice of constructing intrenched camps in the interior of states for the concentration of armies, as places of refuge, where considerable bodies of troops may find protection and succour in case of need, has been adopted on a large scale in Germany, Austria, and on the Rhine, and is now in course of being executed in Belgium. These works far exceed, in magnitude, interior capacity and expense of construction, the limits which have hitherto been prescribed by Vauban, Bousmard, D'Arçon and others, for the construction of in-

* Light field-artillery is falling rapidly into disuse, and the march of improvement is in the direction of increased calibre of guns. The French have long since abolished 4 and 6-pounders, and retain only the 8-pounder, which is fully equal to our 9-pounder. They have further, by a recent decree, abolished the 8-pounder likewise for field service, and adopted a 12-pounder, of diminished weight, as the only gun for field service: the French have abolished likewise, as the Belgians had previously done, all howitzers for field service, upon the principle that guns may fire shells as well as solid shot, but that howitzers cannot fire solid shot as well as shells. Finding that the existing 8-pounders are susceptible of being bored up to the calibre of 12, and may safely fire shot with a charge equal to one-quarter of the shot's weight, to which the charges of the new 12-pounder guns are limited, the Comité d'Artillerie has definitively adopted the system of field-artillery proposed by the present Emperor of the French; and the 8-pounder guns are to be bored up to 12-pounders, which the thickness of the metal will permit to be done without inconvenience.

During the recent campaign in the north of Italy, the French army made great use of rifled artillery in the field; and this appears to have rendered very efficient service in the actions against the Austrian troops.

trenched camps, and they have been formed without regard to the peculiar conditions which have rendered them available in war.

176. The project of forming strongly intrenched camps, as military positions in a country, was revived by Carnot; and it has since been carried out, to a great extent, in the various works which have been executed in conformity with his ideas. The advocates of the system of intrenched camps, refer to the lines of Torres Vedras as a conclusive proof of the advantages of such works, without adverting to the special circumstances which rendered those lines eminently useful, and which take that peculiar case out of the category of intrenched camps, in the true signification of the term. It is proposed here, to refer to the various descriptions of intrenched camps, recommended by the great masters and practitioners of the art in former wars, and to state the evils which have been experienced, when the limitations which those great authorities prescribe have been transgressed: thus, we may be enabled to avoid the errors which have been committed by those engineers who have constructed such intrenched camps in the interior of states, where, being liable to be attacked in any direction, they must be left to their own resources, and, consequently, they must at length be taken, unless relieved in time by an army in the field. The intrenched position of Torres Vedras could not be turned, nor its communications with its base at Lisbon be intercepted; and to this circumstance it was owing that a British army remained there in security till the exhaustion of his resources obliged the enemy to retire.

PART III.

ON INTRENCHED CAMPS.

177. HAVING described the works which have been constructed in Germany, for the purpose of forming intrenched positions about fortresses; and referring to what is stated in art. 101, above, where it is shown that Carnot's system of fortification was designed to convert fortresses into species of intrenched camps, and that it has been carried out with a total departure from the established principles of defence; it may not be amiss, though this work is devoted rather to a consideration of the principles on which is founded the construction of permanent fortifications, to make a few general observations on intrenched camps.

178. Vauban was the first to propose intrenched camps, under the protection of fortresses of moderate size, in order to render them capable of greater resistance; so that the enemy could not pass beyond them, without abandoning his communications with his proper base, and leaving behind him in the fortress and camp a corps of perhaps 15,000 or 20,000 men, which might be available for active operations in his rear. Vauban appears (*Traité de la Défense des Places, Troisième Partie*) to approve of intrenched camps being thus established under the immediate protection of the guns of a fortress, when the garrison of the latter is not strong enough to undertake active operations in the field; the corps intrenched being, at the same time, comparatively small, so that no very fatal results might follow, should the lines be forced, and the fortress captured. But, since Vauban's time, intrenched camps have been extended so far, that they are capable of receiving large armies; which, in some cases, from the weakness of the defences, may be ex-

tated country, and his communications intercepted by a hostile and enraged population, Wellington's army wanted nothing, and augmented in numerical strength: hence, Massena—not daring to attack the British position, which he could not surround—was compelled to retreat, being entirely defeated by the force of circumstances. The lines formed, as Sir John Jones observes ('Memoranda relative to the Lines covering Lisbon'), "the barrier from which the tide of French conquest first receded." The retirement of the French army was followed up by a vigorous, effectual, and most successful pursuit.

182. It is scarcely necessary to recite the fatal consequences to the Saxons of having collected their army, amounting to 14,000 men, in the intrenched camp of Pirna, which they believed to be impregnable, but which Frederick II. determined to reduce, before he undertook other operations. In this project, he was disturbed by the Austrian army under Marshal Brown, who was directed to succour the Saxon army at any price. The King of Prussia first adopted measures to render the retreat of the Saxons impossible, and to prevent the Austrians from relieving them; he then advanced against Marshal Brown, defeated him at Lowositz, returned to the attack of Pirna, and, after various operations, succeeded in taking prisoners the whole Saxon army.^a

183. To prevent the siege of Schweidnitz, to cover Breslau, and be near his magazines, Frederick II., in 1761, took a position between Bunzelwitz and Tscheschen; and then constructed an intrenched camp, which he occupied with his main army, consisting of 56,000 men, with 180 pieces of cannon, exclusive of the field artillery. The intrenched camp was immediately invested by the Russian and Austrian armies: with these it was resolved to attack the intrenched camp; a well-combined project of attack was formed, and all the dis-

Jomini, 'Traité des Grandes Opérations Militaires,' chap. xxviii., tom. iv. p. 101, édit. 1811.

positions for carrying it into effect were made. The Austrian troops assembled at their posts; but the Russian General dissented from the plan, declaring that it was imprudent to attack the King of Prussia in so formidable a position, and unnecessary to do so, because his Majesty would soon be forced to leave it for want of provisions. A few days afterwards, the Russian army raised the blockade, burned their tents, and repassed the Oder, leaving only a small auxiliary corps of 20,000 men with the Austrians (Jomini, *ut sup.*). Marshal Laudon then renounced, of necessity, the hope of attacking the King of Prussia with any success, and returned to the camp of Kunzendorf. "Thus," says Jomini, "the King of Prussia luckily escaped the greatest danger he had ever incurred."

184. The perilous predicament in which the King of Prussia placed himself on this occasion, was subsequently admitted by himself; and the error he committed, in thus exposing himself and his army, his country and his cause, to utter ruin, he strongly condemned: and, while admitting the importance of intrenched positions, when they cover important points and protect communications with a base, by one or by several lines of operation, he came to the conclusion that the very worst resource of a large army, well constituted and well commanded, was to place itself in an intrenched camp, whether under a fortress or not, if the position were liable to be invested on all sides, and to have the communications with its base intercepted.

185. The Duke of Wellington had never more than 80,000 men under his command during the Peninsular War, and never more than 30,000 of these were British troops. His defensive warfare was conducted on the best principles of strategical science; and he never lost or endangered his communications with Lisbon, by the roads leading to that city. His offensive warfare, upon the subsequent lines of operation, was conducted upon the soundest principles: he never permitted his positions to be turned, nor his communications to be endangered; and, to preserve these, he fought and gained the

glorious victory of Salamanca. He never committed himself in so hazardous a position as an intrenched camp, without good lines of communication with the rear; yet, such was his confidence in the efficiency of his army for active warfare in the field, that he entertained a firm conviction that he could go anywhere, and do anything, with that which he commanded.

186. The so-called siege of Sevastopol, adduced by Mr. Fergusson and others as the greatest and most instructive siege that ever took place, was not a siege. It was the attack of a great intrenched tête, whose communications with its base were never interrupted. In this attack, the allied army had to contend, not only with the very strong garrison which the fortress contained, but, through it, with all the resources of Russia; just as the army before the lines of Torres Vedras may be said to have contended against all the resources of England, as they were poured into Lisbon by sea. The most instructive lesson that can be learnt from that undertaking is, never to attempt the attack of a fortress without completely investing it, so that no succour can get in. It was entirely through the inadequacy of the allied army to effect that first condition of a siege, that the attack of Sevastopol was so protracted and so sanguinary; and not because its defences consisted of earthen ramparts.

187. The system of intrenched camps was adopted very extensively by Napoleon at the time when he left large bodies of troops in possession of the numerous fortresses which had surrendered to him on the Elbe and the Oder, in 1813. Those cities, as Magdeburg, Wittenburg, Torgau, Dresden, Breslau, Custrin, Dantzic, Stettin, and Glogau, became, in fact, intrenched camps, and required armies for their defence. The measure was, no doubt, adopted under the expectation of being able, in his next campaign, to carry the war through Prussia and Silesia into Poland; and, had he been able to do so, he would at once have recovered military possession of the country, and, with it, those important places: but, as events proved, he was deprived of a

of refuge for large armies, whether formed on insulated points or under fortresses. He considers that it would be far more advantageous that an army should keep the field; falling back if necessary, or forming itself into a corps of observation, for the purpose of covering a fortress.

190. It is not with a view to deny that fortresses occupying important strategical points in the interior of a country may, with advantage, be provided with a system of detached works so far in advance of the place as to enable armies in the field, or divisions thereof, to take shelter within the space which those works enclose, in the event of defeat—there to wait for reinforcements, which may enable them to resume the offensive; but to question the modern practice, of enfeebling the defences of the fortress around which the intrenched camp is formed—as at Verona and other places—in such a manner as to render the fortress itself insecure.

In 1805, Ulm was the scene of events very different from those which took place there in 1800, when General Cray so gallantly arrested the victorious army of Moreau for six weeks before its walls.

The Austrian general, Mack, who had been put at the head of 50,000 men, was ordered by his government to advance into Bavaria, and occupy the line of the Iller; there to oppose Bonaparte, who was coming up rapidly with his whole army, consisting of the divisions under Bernadotte, Marmont, Davoust, and Soult—amounting to more than 100,000 men. These completely intercepted the communications of the Austrian army with Vienna; but the road to the Tyrol being open, the Archduke Ferdinand, with the cavalry and light troops, retired in that direction: and Mack might have done the same—by which movement he might have formed a junction with the Russian auxiliary force, which was advancing, with the Emperor at its head; but, either controlled by the orders of the Aulic Council, or misled by an error of judgment, he concentrated his troops at Ulm, where he suffered himself to be surrounded by the whole French army, commanded

to render that position as strong as the defensive art can make it, in order that it may check the advance of an enemy into Southern Germany : but an intrenched camp there should not be left to its own inherent power of resistance, and the retreat from thence towards the capital should be secured ; otherwise an attack upon it will, assuredly, be attended by circumstances similar to those which have been above described.

191. Intrenched camps should combine defensive and offensive faculties : the camp may be formed in contiguity to a place, and armies may, in case of need, take refuge in them ; yet the camp itself should be an offensive position, from which the troops it contains may be always ready to take the offensive in the field. To place in such camps troops of secondary character, incapable of acting efficiently in the field, would deprive an intrenched camp of the great object for which it should be constructed. None, therefore, but well appointed and well exercised troops, fit for any service in the field, should occupy intrenched camps, on strategical points.

192. Bousmard, in his '*Essai Général de Fortification*' (liv. v. chaps. 7, 8), has some important observations on the evils arising from troops being shut up in intrenched camps. Attributing to Vauban the practice of forming such camps under fortified places, he presumes that this great engineer, foreseeing that the formidable league (1696), against which France had long struggled, would, in the end, dissolve itself by differences among the states which composed it, conceived the idea of executing intrenched camps with the view of prolonging the war till such dissolution should take place. "But," observes Bousmard, "how can the army in its intrenched camp avoid a general action, without being itself besieged by the enemy. . . . The attack of the intrenched camp will be a less difficult operation than the siege of the fortress ; and, the camp being once forced, the attack of the fortress will be comparatively easy. The place will be encumbered

rather than strengthened by the army of the camp, and the space which the troops require will be seriously restricted; so that they will neither be able to develop their means, nor to apply them efficiently for the purposes of defence," (see Art. 152, where the weakness of Verona, in this respect, is indicated). Bousmard adds, "All places are not so situated as to admit of intrenched camps being formed near them, and Vauban took particular care to indicate those which might be so strengthened."

Treating of extensive lines of intrenchment serving to cover the frontiers of a state, Bousmard observes (chap. viii.), "As to the defence of these lines, I think it may be conducted in the following manner. The main body of the army on the defensive, should choose a position near the centre of the line; having lines of communication, or roads, prepared, by which it may march upon the principal points on the circumference of the line. Advanced corps upon each of these roads should precede the army, and sustain the first attack of the enemy—at whatever point that may be—on the intrenchments. The army should follow; but, instead of developing itself along the whole line, it may, after reinforcing the advanced corps, where necessary, hold itself in readiness to attack the enemy with advantage, at the moment of an effort being made to penetrate within the line of intrenchment.

Whoever compares what has just been said with the description given by Colonel Sir John Jones ('Memoranda relative to the Lines covering Lisbon,' pp. 30, 31, 50, 51; London, 1829) of the measures adopted by the Duke of Wellington, in occupying the lines, and in obtaining, by signals, almost instantaneously, intelligence at head-quarters from every part of the lines, when he spread an army not amounting to 50,000 men on a front of twenty-nine miles in extent, will immediately feel that the conception of those lines was founded on the best principles of tactical science; and, while the success of the measure demonstrates the importance of strongly intrenched camps in particular

circumstances, it affords little ground to expect that, unless the highest resources of art are combined with the obstacles afforded by nature, so as to render the position impregnable on its whole contour, the end proposed in intrenching the position will be gained. (See pages 66, 67, of the work above quoted.)

193. The defence of a state by a judicious disposition of the fortified places within it, or on its frontiers, is the most important branch of military science; and to lay down the principles on which military posts should be established in a country, is an object of the first importance. The establishment of such posts becomes a means of rendering the conquest of a country so much the less rapid, as the invader is detained longer in the attempt to gain possession of them. It was one of the maxims of Napoleon I., that "Fortified places are useful for defensive as well as for offensive war: *but they cannot serve instead of, or dispense with, an army.*" A small state, incapable of defending itself against a powerful neighbour—but its independence guaranteed by treaty and by contiguous powers—will of course do well to shut up in fortresses all its military force, so as to give time for the arrival of succour from without. But a great nation standing upon its own military resources, must not carry its defensive system by fortresses so far as not to leave troops adequate to form a powerful force in the field. If the invading army lay siege to those fortresses, large portions of its troops will be required to carry on the sieges, and to form corps of observation to protect the operations. A large active army in the field may interrupt a siege, by forcing the invaders to concentrate; but if the invaded country carry the system of defence by fortresses so far as to be unable to keep a powerful army in the field, she will unquestionably run the risk of being beaten in a detailed war of fortifications; and this, as the author will hereafter show, might be the case with England.

194. It must not be understood that every accessible point on the frontier of a state should be occupied by a

the sea-coast, so that an enemy may be unable to turn it; and, the nation to which the army occupying it belongs being supposed to have the command of the sea, the supplies may at pleasure be landed from the shipping employed to convey them. And it is evident that the interior of an extensive country would be most improper for the establishment of an intrenched camp, since the position chosen may be surrounded; so that the arrival of supplies may be prevented, and the retreat of the defending army in danger of being intercepted.

196. Extensive lines of intrenchment, to cover the frontiers of a state, had at one time great reputation. They afterwards fell into discredit. If liable to be penetrated anywhere by the enemy, they are useless. If they consist of detached forts, requiring not more for their garrisons than 300 or 400 men, with five pieces of artillery per league, in their extent; if the intervals between the works are strengthened by abattis or inundations; if the extremities are protected by strong works, or by the natural obstacles of the ground; and if there are interior intrenchments, or strong reserves of troops, placed where they may be readily brought up to resist an attack at any point which is menaced—such lines cannot but be of great advantage to an army acting on the defensive.

197. Belgium has long been covered with fortified places, which, since the termination of the war in 1815, have been strengthened by all the resources of art under the direction of British and Prussian engineers; so that the whole country may be said to form one vast intrenched camp: the ground between the several fortresses being so commanded by them, that an army, numerous enough to attempt an invasion, could not move on it, without having its communications intercepted at every moment. These fortresses are particularly numerous in the southern part of the country; which led Napoleon I. to say that, whoever occupied the line of the Meuse would be master of Belgium.

Yet, it is now almost decided to dismantle all the

protected westward by seven detached forts, each at the distance of about 1600 yards beyond it, and terminated, on opposite sides of that river, by two strong forts, one of which is the old citadel, which was besieged by the French after the separation of Belgium from Holland in 1830.

The question lately agitated in the councils of the nation was, in what manner the fortifications should be traced. One proposition was that the whole of the enceinte, and also the detached forts, should be formed on the bastion system, similarly to the enceinte and forts about Paris; but that of Captain Brialmont is to form the enceinte on the principles of the polygonal fortification; the ditches being defended by artillery in casemated caponnières, and these being covered by ravelins in the form of segments equal to, or greater than, semicircles. This engineer proposes also that the detached forts shall be of an elliptical form, with the longer axes parallel to the nearest fronts of the enceinte; their ditches being defended by projecting caponnières, similar to those described in the account of Mr. Fergusson's system.—(Art. 157.)

It is debated whether the ditches of the place shall be dry or wet; and, if dry, whether they shall be reveted with masonry or not. If a wet ditch is resolved on, the water, it is said, could not in some parts be kept deep enough without constructing batardeaux, and these would be liable to be destroyed by the enemy. It is, also, desired to avoid the expense of revetments, should the ditches be dry; and an appeal is made to the experience of Sevastopol, which seems to prove that neither a wet ditch, nor a revetment in a dry ditch, is indispensable.

199. The question of fortifying Antwerp was for a time adjourned, but it has been lately resumed. It was urged that shot and shells from the artillery of the present day will be able to reach the centre of the town; and thus, the great extent given to its fortifications will be no security for it against a bombardment: it is added, that iron-plated steam gunboats might pass the

forts on the Scheldt, and destroy the town in spite of all the fortifications. The like objections may be made to a proposal for fortifying the capital of any country: the necessity which a state is under of preserving the lives of several hundred thousands of citizens, men, women, and children, and the vast amount of property in a capital, would compel the authorities to make terms with the invaders before these have arrived at the environs, within the range of artillery. It is evident now, as was long since shown by Rogniat and other French engineers, that fortifications must be employed only for the defence of purely military positions; in which, without being embarrassed by civil occupants, an army, unable to keep the field, may obtain protection and wait for reinforcements.

200. Another circumstance has, no doubt, contributed to the postponement of any decision on the part of the Belgian government, on the subject of making Antwerp a place of great military strength:—a process of Nature is now going on, which threatens, in no long time, to diminish its importance as a commercial city; and this cannot but affect the question, whether or not it is the most fitting place in the country for an intrenched camp.

During the time of the French Republic, and subsequently, in 1830, surveys of the Scheldt were made, from which it has been ascertained that great changes have taken place in the soundings, and that the sand-banks have increased in height. This circumstance has been notified several times to the Belgian government; and, in 1856, a commission was appointed to examine the river and report upon its condition. The report states, that the depth of water has considerably diminished, and that the river has long had a tendency to divide itself into two branches. In places, where the breadth of the river exceeds 600 yards at low-water, the bed rises in the middle, and the depth near the shores, which are wearing away, is increased. All the *deeps* contain, however, at present, water enough, except that between Fort Frederick and the isle of Saftingen,

where the river cannot be navigated with certainty except at high water, when the depth is from 20 to 22 feet. Immediately to the west of Fort Bath, in South Beveland, there is also a rising of the bed, where there is now only a depth of 19 feet, when, in 1830, the soundings indicated much more. Before the town of Antwerp, where, formerly, many ships of the line could ride at anchor, there are now only three places where ships drawing 22 or 24 feet water can *swing* on their anchors; and at low-water even this can be done only with many precautions, and with kedge-anchors and warps. In fact, there is no place between Antwerp and Vinkemère where large ships can ride at anchor in safety; and the part of the river above Antwerp experiences changes still more detrimental to navigation.

M. von Alsten, also a Belgian officer, has proposed the city of Termonde, instead of Antwerp, as the most convenient site for the formation of a great military work.

Though the fortification of Antwerp has been for the present postponed, political reasons may soon render it necessary for the Belgian government to return to the subject, for the purpose of putting the country in a condition to make a prolonged resistance, in the event of being invaded. The best interests of all the states in the north of Europe, including Great Britain, are involved in the independence of both Belgium and Holland. Should those countries be again united to France, the resources of that empire might be employed to remove the obstructions at the mouth of the Scheldt; and Europe might again behold the plans of the first Napoleon carried into effect by the reconstruction of the docks at Antwerp, and the formation there of a northern Cherbourg for the French warlike navy: a circumstance which would compel Great Britain to keep, as she formerly kept, a powerful fleet in the North Sea, as well as in the English Channel.

201. From the tone assumed of late by some of the French papers, we are led to imagine that the present Emperor, Louis Napoleon, has taken umbrage at the

intention of the Belgian government to form an intrenched camp at Antwerp, conceiving, we presume, that the measure implies an apprehension that the Emperor has designs against the independence of his neighbour—such apprehension indicating an unworthy distrust of his sincerity. In the papers alluded to, it is alleged, and the allegation is adopted by the editor of the 'Nord,' a Russo-Belgian paper, that such a project is conceived in violation of the articles agreed to at the Congress of Vienna, in 1815, particularly Art. 15, in which it is stipulated that the works constructed in Belgium, under the orders of the first Napoleon, shall be demolished; as well as of the articles agreed upon in the Conference of London, in 1831, on the subject of the separation of Belgium from Holland, in which it is decided that Antwerp shall become an open commercial city.*

The author demurs to the opinion that the Belgians have not a right to form strong military positions in their own country—such a measure being purely defensive; and no reasonable person can imagine them to be designed with any other view. The stipulation made at the time that the Congress of Vienna was held, that the fortifications of Belgium should be demolished, was directed against French aggression, because it was felt that these might become as many strongholds which France might occupy, and by which she might keep the country in subjection. But Belgium is now an independent kingdom, and has as much right as any other state to secure itself against foreign invasion, from whatever quarter the invasion may come.

We do not pretend to assign the reasons for the dissatisfaction attributed to the French Emperor, on

* It is well known to have been, at one time, the intention of Napoleon I. to enlarge and strengthen the five fronts of fortification on the north side of Antwerp; and, after the expedition to Walcheren, to form an intrenched camp about the city, nearly in the same place as that which was proposed to the Belgian government in 1848; this intention being confessedly with the view of rendering Antwerp, as that emperor expressed it, '*un pistolet chargé sur la cuirasse de l'Angleterre.*'

account of the fortifications contemplated by the Belgian government, and we have full confidence in that monarch's expressed desire that the peace of Europe should be undisturbed; but we venture to assert that if any one of the enemies of Louis Napoleon were disposed to impute to him sinister designs on Belgium and Holland by the opposition which the French journals make to the proposed extension of the fortifications of Antwerp, he might, from this opposition itself, derive strong grounds for suspecting that, in the event of a war breaking out, attempts might be made to extend the frontiers of France as far as the Rhine.

The Belgian government and legislature will not, apparently, be deterred by foreign influence, or conditions established in by-gone times, from adopting whatever measures of defence may appear to them best calculated to provide effectually for the safety of their country; and we find that on the 6th of September last, the senate of Brussels adopted the first article of a Bill for carrying on the fortifications of Antwerp by a majority of 18 (34 votes against 16); and no doubt His Majesty the King of the Belgians would be most effectually supported, should he proceed at once to carry into effect, with as little delay as possible, the only project by which the national troops and the aid of his allies can be rendered available for securing the independence of the state.

PART IV.

A TRACT ON THE NAVAL, THE LITTORAL, AND THE
INTERNAL DEFENCE OF ENGLAND.

202. HAVING fully examined the defensive works which have been constructed by the principal continental states of Europe, since the termination of the great war in 1815, which examination may have some important bearing upon the question of the defensive works requisite for the security of this country, the author is desirous of entering upon a description of that mixed system of defence, which he would venture to offer as a practical measure for the security of an insular, maritime, and military power, like that of Great Britain. The proposed measure will consist in a comprehensive organization of all the resources which constitute our national strength, in such a manner as may admit, hereafter, of a prompt reduction of our establishments to their just amount in a state of peace; that thus the finances of the country may not be overburthened, through the necessity of keeping up extensive works, which could neither be maintained nor demolished but at an enormous expense. The author trusts that he shall be able to show how this may be done, consistently with the preservation of our warlike arsenals in states of perfect security, and how the country may be enabled effectually to prevent an invasion, or defend itself against the consequences, should such an event take place.

203. When the navies of Europe had been swept from the face of the ocean by the gallant achievements of the sailing navy of Great Britain, and her supremacy at sea had been firmly established in every region of the earth, Napoleon I. affected to imagine that, favoured by tempests which might scatter our fleets, or by superior strategy, he might obtain a temporary superiority in the British Channel, which would render it possible

for him to make a descent on our shores. This was considered rather as a menace than a probability, and, accordingly, it was little regarded by the people of this country: the battle of Trafalgar seemed to put an end to every chance of success, and the idea of an invasion ceased to be entertained.

204. Vast changes have taken place in the maritime affairs of all the nations of Europe since the termination of that war; and the introduction of steam, as a propelling power for ships of war, will necessarily modify—and, to a great extent, overturn—the still existing tactics of war on the ocean. And, though we may entertain a strong opinion that the maritime strength of Great Britain will rather be increased than diminished by the use of steam for the propulsion of our ships of war; yet it would not be prudent to assume a certainty of success in a new, and, as yet, untried, mode of naval warfare for the protection of the country, with as much confidence as in times past, when, in then existing circumstances, Great Britain proved herself invincible at sea.

Amongst the changes which steam-propulsion for ships of war will introduce in naval operations, may be included the abandonment of the blockade system. For a steam fleet superior in strength to the fleet blockaded—if well supplied with Armstrong's incomparable guns, and other descriptions of rifle cannon, and with abundance of mortars for firing at high elevations—will be able to destroy from afar the fleet, or the arsenal in which the ships are crowded, and probably both, at the same time. Thus, it will not be necessary to keep a steam fleet before an enemy's port during long intervals of time, as was the case formerly with our blockading fleets of sailing ships; which were, often in vain,—from the enemy remaining close in port,—kept knocking about in all weathers on the sea, with great danger to the ships, and at enormous expense to the nation.

205. On contemplating the steps by which England and France made the great transition from a sailing

to a steam navy, it will be seen that our country took the lead. England worked out the new problem, experimentally, during many years, and at vast cost; while France, profiting by our labours, at once put in practice the results of our researches. English artists discovered that the screw was the fittest instrument for the propulsion of steam ships of war; and the screw, the French immediately adopted. France, having few sailing ships of war, began immediately, with great industry, to construct new ships of the line with screw-propellers; and furnished them with engines of great power. On the other hand, England, having a vast number of sailing ships of every class, endeavoured to turn them to account by converting them into steamers; and it was not till after much delay and expense had been incurred, that we succeeded in forming a steam fleet, by the construction of new ships, on the most approved principles.

206. The efforts of France have been particularly directed, during the last ten years, to the re-attainment of that rank which she formerly held among the naval powers of Europe; and the steam fleet of France has, during the whole of that period, been in a state of progressive augmentation: the government of that country having steadily acted upon the recommendations propounded in the 'Enquête Parlementaire' (1849), and it is now equal, if not superior, to that of Great Britain. The author having procured a copy of that document in 1853, deemed it his duty to submit to Her Majesty's Government copious notes and extracts from the proceedings of that commission, showing the vast sums voted, and proposed to be employed during the ten years which were to follow. The author, also, pointed out the spirit of rivalry, if not of hostility, both implied and expressed in that official document. These 'Notes' were printed confidentially, in 1853, at the private press of the Foreign Office;* and he must observe, that

* This is the document referred to by Mr. Cobden, in his speech of the 29th July, 1859; but he gave it a colour very different from that which it clearly

we ought to have begun, as unostentatiously as the French began, to take countervailing measures, in order to maintain the numerical superiority of the British steam fleet, instead of deferring the step, as it was deferred, during several years. By this postponement, the progress made by the French becoming generally known to the public, the country is thrown into consternation by the announcement that there must be made immediate and extensive additions to the British navy, in order to make up for the time which has been lost.

207. The changes which political events have produced in the maritime affairs of all the nations of Europe, and the great improvements which have been made in naval constructions and armaments, and particularly the introduction of steam as a motive power, since the termination of the wars arising from the great French Revolution, are matters with which it behoves the statesmen of this country to be thoroughly acquainted. One great naval power in Europe has disappeared as such, and another has sprung up in the New World. The steam fleet of France is in a state of progressive augmentation; the Government of that country having acted upon the decision of its 'Commission d'Enquête,' of 1849,^a and it has now attained a very formidable degree of strength. The division of the Russian fleet now in the Baltic, amounting to about 40 sail of the line, will speedily become a steam fleet; and the navies of the minor powers, Denmark, Sweden, and Holland, under the able administrations of those countries, are in a very efficient state. In short, the navies of Europe and of America have so increased in the number and strength of the ships, and their *personnel*—in all that relates to the science and practice of war, that, in a future contest, the sea will become the theatre of

shows. The confidential character of that document having thus been violated, it may, very properly, be cited by the author.

^a See the 'Enquête Parlementaire, sur la Situation et l'Organisation des Services de la Marine Militaire, ordonnée par la Loi du 31 Octobre, 1849. Paris, Imprimerie Nationale, 1851.

events, more important and decisive than have ever yet been witnessed.

208. It has been said that the efforts of our nearest continental neighbours have been particularly directed during the last nine years to the re-attainment of that rank and consideration which their nation formerly held among the naval powers of the world; and, admitting this to be a just and laudable policy for France to pursue, Great Britain should, at the same time, keep steadily in view the measures now being carried out in that country, conformably to the recommendation of the Commission of Inquiry just referred to; and must take corresponding measures to increase in due proportion the power, efficiency, and numerical strength of her naval forces, in order to maintain her present position. Thus, the naval arsenals of two great nations in alliance with each other, one of them impelled by a necessity of the first and highest order—that of providing effectually for its own security,—are resounding with the din of warlike preparations; while both nations might be participating in the financial advantages and social benefits of a sound, substantial, and lasting peace.

Viewing France as that which she really is, a great power, whose safety depends upon her military forces, we have no right to cavil at any measures which the Government of that country may adopt for its own security against its powerful continental neighbours. Her military preponderance is as essential to her safety as the maritime preponderance of Great Britain (an insular and colonial power) is indispensable to hers. Neither should be jealous nor distrustful of the other, in any legitimate use which either may make of the powers with which nature has endowed them, respectively, for providing effectually for their own safety.

209. Preponderating naval power not being essential to the security of France, the effort to acquire it can only be considered as a hostile measure towards Great Britain—to which naval supremacy is indispensable, and must be maintained at any cost.

The author makes these observations in no unfriendly

spirit: he takes the facts and circumstances which prove that the French are actuated by sentiments inimical to our naval superiority, as he finds them recorded in official documents; and he uses them merely in proof of the necessity which Great Britain is under, as an insular and colonial empire, of maintaining her position by keeping up a navy which will protect her, not merely against any one maritime power, but against any coalition to which political circumstances may give rise.

Whilst the naval power of France, in the event of a war, will be chiefly collected in the two seas, on the shores of which her great arsenals are established, the navy of England must be dispersed over the whole world, with strength sufficient in every region to protect her numerous colonies and widely extended commerce; and, at the same time, have dominant power in the waters which surround the British islands. For both of these great objects she cannot provide, with a navy of its present strength.

210. Sincerely disposed to maintain, in his humble sphere, the friendly relations which happily subsist between the governments of Great Britain and France, the author cannot but approve of the policy by which France is actuated, in so re-organising her maritime resources as to enable her to regain that position which she formerly held as one of the great naval powers of Europe. The Commission of Inquiry, in its sitting of the 3rd February, 1851, decided, that the number of ships of the line, which, by the Ordonnance of 1846, was limited to forty, should be increased to forty-five; and that each ship should be provided with steam power. This was the number adopted; but it appears, from the discussion which took place on the occasion, that the proposition of M. Charner—one of the members of the Commission—to increase the number to fifty ships of the line, was rather postponed than rejected. It was recommended to have the greatest number possible of ships of the line finished, afloat, and ready armed, whenever they might be required. The reason

for adopting the smaller number was, that forty-five ships would be finished in less time; and thus the funds voted would be economised, and the country be better prepared, in the event of war soon breaking out. The number of ships actually finished is forty-seven; and there is little doubt it will soon amount to fifty, as proposed by M. Charner.

211. In the sittings of the 12th February, and the 10th March, 1851, it was resolved that the number of steam-frigates, *à grande vitesse*, should be twenty; of frigates, moved by sail and steam, also twenty; at the same sitting it was decided that the number of corvettes should be fixed at fifty, and that there should be eighty avisos. It was also decided that the construction of the twenty swift steam-frigates, and the fifty corvettes, should be completed gradually within the next ten years: at the same time, it was determined that all sailing transports should be suppressed; and that, instead of them, there should be twenty steamers to serve as transports.* The line-of-battle steamers are recommended to be built on the model of the 'Napoléon,' formerly the 'Vingt-quatre Février': the engines of this ship, though rated at 960 horse power, can be worked up to 1500 horse power, and the ship is capable of stowing coal for ten days, when steaming at full speed. It was subsequently resolved that the "Equipages de ligne" (ships' crews), and the "Mécaniciens," or engine-men, should continue to be kept up by means of the maritime conscription; that fourteen ships of the line, then afloat, should undergo the alterations necessary to convert them into steam-ships; that the number should be made up to thirty from the ships then on the stocks, and that twenty of them should be completed within ten years.

The decisions of French Commissioners, on subjects referred to them, are not subject to change with a

* The transport 'Calvados,' which was lately launched at L'Orient—the first of twenty vessels of the same class—is said to have accommodation for 2500 men, 150 horses, and 1200 tons of stores.

change of government, as with us: they are, on the contrary, immutable, and are perseveringly acted upon till they are effectually carried out. It is well known, that the idea of constructing a great harbour at Cherbourg originated with Louis XIV., though the work was commenced only in the reign of Louis XVI.; and in the last year, 1858, we saw the completion of that vast work, which, in the language of the President of the Commission appointed in 1849, "is to contain the fleets which are to defend the French coasts, and attack the English in their own country."^a

In the decision respecting the establishment of ships' crews for manning the forty-five ships of the line decreed by the Ordonnance of 1846, it was regulated that an adequate increase should be made in the number of companies, each of which was appointed to consist of sixty seamen of the first, second, and third classes, with twenty seamen apprentices; also, that the establishment of seamen-gunners should be on so large a scale, that there might be one well-trained gunner to every gun in the ships to which they should be drafted.

212. Manning the British navy was, in former times, so promptly accomplished by compulsory service, that often the dangers which menaced the country by sea were arrested by a consciousness, on the part of the enemy, that our fleets were fully prepared to oppose any attempt at aggression.^b But now that we have

^a In a speech delivered at a sitting of the Commission of Inquiry before referred to, Jan. 27th, 1851 ('Enquête Parlementaire,' tom. i., p. 149), M. Daru, after observing that, in the expedition to Rome, the whole French army was embarked and conveyed in ten days from Toulon to Civita Vecchia, infers that 24 steam frigates, 24 transports, 3 corvettes, and 3 avisos, concentrated at Dunkirk, Cherbourg, or Brest, would suffice to disembark 30,000 men and 3000 horses on any part of Great Britain or Ireland.

^b As an instance of the kind of menace which was held out by influential persons in France against this country, we give the following quotation from the speech of M. Granier de Cassagnac, and published in the 'Constitutionnel,' August, 1859:—

"Before the Revolution, soldiers in France were raised as soldiers and sailors still are in England. Sub-officers, crowned with laurel, traversed Paris, mounted on carriages preceded by fifes and drums, and followed by carts laden with hams, fowls, and wine. At every publichouse a halt was made, and recruits were enrolled, who were seduced much less by the prospect of glory than by

renounced the practice of compulsory service, and depend upon voluntary enlistment for the supply of seamen to man our ships of war, whilst the French have greatly extended and organized their system of compulsory service to man promptly their fleet, the case is materially altered. Far from being able to deter aggression, we invite it. The commencement of a naval war will always be a period of comparative weakness for us, whatever be the abundance of the material for arming the ships, if the men who are to serve in them are not immediately forthcoming at the time of need. But this being so, there can be no security for England should she reduce her naval and military forces to a peace establishment in the same proportion as the forces of her neighbours may be reduced. That made by France would consist in the *licenciement* of the men, said to be reduced, to return to their respective *foyers*, all of whom, whose period of service had not expired, would be subject to be called back at any moment, with as many more fresh men as might be required. The reduction of the forces of Great Britain would be a *bonâ fide* discharge of her soldiers, a paying off of ships, and a dispersion of their crews; to restore which to a war establishment could only be done by the slow processes of enlisting and drilling raw recruits, and of raising seamen by voluntary engagement: while the men thus obtained would moreover be totally unskilled in the exercises of war.

In times gone by, when the naval superiority of England was firmly established, and her fleets could at any moment be powerfully manned, the peace

good cheer. The Revolution of 1789 created our present army. Civil and political equality has imparted to the soldier dignity, emulation, and love of glory; the organization of the Consulate, and of the Empire, has raised the army to its highest power, by giving it, with discipline, the useful employment of all its strength. At the present day there exists not in the world an army at once better provided, better administered, better fed, better kept, better instructed, or braver than ours; and, when once there shall have been completed the service of marine transports, which will permit the unexpected throwing of a *corps d'armée* on a point of the enemy's shore, the enemies of France—or those who are jealous of her—will have to think twice before provoking her."

establishment of her navy for home service, in particular, was very much reduced; whilst her standing army was maintained in great strength, notwithstanding the constitutional scruples and financial objections to provide for a large military force: but in these days, this principle of reduction should, for the reasons stated above, be reversed. We should keep up, without reference to what any other nation may do, a large standing active navy, fully manned with well-trained gunners and seamen, with reserves to boot; and then we might concede to constitutional scruples, and the objections of the economists, the folly of keeping up likewise a large standing army: provided always, that the militia force is complete on paper, ready to be called out; and that all our scientific corps and appurtenances—which, like the fleet, require well-skilled men—are well kept up, and we might carry the savings to the account of the navy estimates. No constitutional or financial objections would, we presume, be made to such a measure.

213. France, on her side, cannot reasonably complain of anything that may be said or done in this country to provide for its safety by an adequate augmentation of its fleet. The passages we have quoted from the proceedings of the French Parliamentary Committee, show that France has taken the initiative in augmenting its naval force. Not only has the French steam fleet become numerically equal or superior to ours, but, through the alliance with this country, it has had vast opportunities of improving itself in warlike practice; particularly of the kind which is the subject of this chapter—the forced descent on an enemy's coast. Our successful landing at Aboukir Bay on the 8th of August, 1801, and the more recent landing of the allies in the Crimea in 1854, prove sufficiently that a disembarkation might, if not resolutely opposed, be effected by force—provided the invaders have even a temporary superiority on the ocean. In the late invasion of Italy, France, by our neutrality,

has held the trident as well as the sword, and has been enabled to combine naval and military operations with as much facility as if the Mediterranean were indeed a French lake.^a Neutrality being our policy, we have no ground for complaint; and the circumstance is mentioned only as illustrative of the power which a nation acquires by having the command of the sea.

214. It follows, from what has been said, that it is in the highest degree obligatory on the Government of this country to prevent the British Channel from being crossed by a hostile fleet: all the resources of Great Britain, personal and material, should be devoted to this object, as the only effectual means of preventing her from experiencing the miseries attending a successful invasion. Great advances have been made towards the attainment of this important object by Sir John Pakington, the late First Lord of the Admiralty; and, if the steps taken by that minister be followed up with energy, an attempted invasion may be averted, and the highest duty of the Government will be accomplished.

215. The expense of constructing a steam navy, ad-

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^a Detailed instructions, for the very difficult operations of embarking and disembarking troops, were drawn up to regulate the embarkation, at Boulogne and other ports, of the army for the invasion of England, and for the debarkation of that army on some part of the English coast, and were published for the first time in 1809, in a '*Traité sur le Service de l'État-Major Général des Armées*, par M. le Général Grimoard'—a work which should be in the possession of every staff officer, and be made a class-book in our Staff-college. The reader of the eighth chapter of that book will find, in the detailed instructions therein given, sufficient to account for the order and regularity with which all stores and equipments for the French army were arranged and easily got at; whilst evils the most serious were experienced by our troops in the Crimea, from the disorderly manner in which stores of every description were thrown, without classification, and, it is said, without invoice, into the British transports.

General and staff officers, who may be employed with troops prepared to oppose a landing, will do well to consult this important work: more particularly the parts which relate to a debarkation in presence of an enemy, and the modes by which a lodgment may be established. For this, *chevaux-de-frise* should be placed on first landing, to defend the troops against cavalry, whilst pioneers should be pushed forward to throw up slender defences in their front, some of the pioneers being provided with petards to force entrances into any adjacent buildings of masonry, which should serve as military posts to cover the formations of the invading troops, (a striking specimen this of the stern realities of war, and of what the British householders may expect, if, unhappily, the invaders should make good a landing on the shores of this country).

equate to prevent the invasion of England by dominant fleets in the British Channel is as nothing when compared with the enormous destruction of property and life, and the other deplorable evils which must attend the presence of an enemy upon our soil. The author would, therefore, urge the Government to build forthwith as many more ships as can be required for that great purpose; also to provide in time plentiful supplies of certified seamen-gunners and ordinary gunners: it must not doubt that able seamen of the best description may be obtained in time of need; provided the service is rendered as attractive as possible, and nothing retained in it that may be repulsive to the feelings of good men. For this, corporal punishment should be abolished, excepting when awarded by the sentence of a court-martial, the proceedings and finding of which should be approved, and the sentence be carried into effect, by order of the captain of the ship, or of the officer commanding the squadron, or fleet, to which that ship belongs; thus assimilating the naval to the military martial law in that respect—a concession which the author ventures to urge as a measure of the very highest degree of importance and expediency. But, above all things, restore to the men proposing themselves for enrolment in the navy the prospect of obtaining prize-money from the captures they might make at sea. England has recently abandoned the right, which nations in a state of war have, to make prize of neutral vessels, when proceeding to the ports of one of the belligerents, if laden with articles which are contraband of war. Such abandonment of belligerent rights, with respect to neutral powers, must tend to encourage the contraband trade, and thus to diminish the injury which a maritime war, under other circumstances, would inflict on the commerce of that nation which, during war, has not the command of the sea; and consequently tends to the prolongation of hostilities between the belligerents. The war with the United States, in 1812, arose entirely from the Government of that country denying that Great Britain

had such right, American ships being then the carriers of the trade of France; France also denied it; and both those powers contended that neutral flags covered the cargoes, rendering them also neutral. Great Britain, on the other hand, adhering to a well-established principle in the law of nations, asserted that a neutral flag does not cover the cargo, when consisting of warlike stores, if the vessel is bound to a belligerent port. It was by acting on this principle that the officers and crews of British ships of war obtained so much prize money, during that and the preceding war. But, in the late Russian War (1854), no such advantage accrued to our seamen; for, while British fleets blockaded the Russian ports in the Baltic, Prussia, in consequence of the principle being abandoned on this occasion, seeing her advantage in remaining neutral, enriched herself prodigiously by carrying Russian produce to and from the ports actually blockaded.

With respect to the question of manning the British navy, it must be observed that if the prospect of obtaining prize-money from the captures of neutral vessels carrying warlike stores to an enemy's port be abandoned in the war for which preparations are being made, the great pecuniary inducement to seamen to enter the naval service of the country would be wanting.

No one who has not lived, as the author has, through the stormy times of the great war, from 1792 to 1815, will be able to conceive how noble was the patriotism, and how indomitable the spirit, of the British people throughout that great struggle. There was then, as there will ever be, party spirit and some internal discontent; but, in the main, no wavering or despondency appeared throughout all the vicissitudes of the war: the rebellion in Ireland, the failure of some of our foreign expeditions, the rupture of the many coalitions which we formed with continental powers, the military dominion of Napoleon over the greater part of Europe, which left us to fight him single-handed through Spain, did not make England quail. Even in the mutiny

of the navy, in 1797, the seamen were not traitors to their country; and Admiral Duncan fought the battle of Camperdown with ships' crews deeply tainted with the mutinous spirit which discontent had produced. Ships provided by the Government, including some of the larger vessels of the East India Company, were actually fitted out and *manned* by volunteer seamen, in order to reduce by force those ships from which the mutineers had expelled their officers. Even the crews of the fleet at Spithead, when the mutiny was at its height, declared that if the French fleet should put to sea they would fight it as loyal subjects of their king and country.

216. In proof that the most strenuous exertions should be made to prevent the enemy from effecting a landing on our coast, the author may perhaps be allowed to repeat here the well known fact, that Cæsar, in his first invasion of Britain, about 55 years B. C., being courageously opposed by the natives, was nearly prevented from effecting the landing: whereas, in the following year, meeting with no opposition, he encamped his army on the shore, and, advancing from thence into the country, he engaged and defeated the Britons; and the island remained a Roman province during 400 years.^a

^a The galleys of Cæsar approached the British coast near Hythe, with a rising tide and a wind blowing from the east; when the Romans beheld the shore occupied in force by the natives, who so annoyed them by showers of javelins, that they dared not venture to land. Cæsar, perceiving this, ordered up some of his triremes to protect the debarkation by stones and arrows, discharged from slings and cross-bows. The contest was, however, long doubtful; but at length the soldiers—following the standard-bearer of the renowned tenth legion, who was the first to throw himself into the water—got a footing on the shore.

At the second invasion, in the following year, Cæsar arrived on the same part of the coast, with a much greater force, and effected a landing without opposition; the army of the Britons having retired from the coast, doubtful of its power to oppose the landing of so large an army as 800 or 1000 galleys were supposed to convey to their shores.

Cæsar having landed, established his camp, probably on the high ground about Limne. This he fortified, and advanced immediately towards the army of the Britons; whom he found in position in Challock Wood, on the north side of the Stour.

See 'Invasion of Britain by Julius Cæsar,' by Thomas Lewin, Esq.; pp. 45 and 86. Longmans, 1859.

217. If, unhappily, an adequate British fleet should not, at the time of a projected invasion, occupy the Channel, the fate of England will depend entirely upon the means of defence to be provided on the coast, and in the interior of the country. To render the former more formidable, it has been proposed that portions of the naval force shall be employed to impede a landing: it is recommended, for example, to use the line-of-battle block ships, as floating batteries, in aid of the coast defences. In the opinion of the author, this would be a great misapplication of naval means. Floating batteries could only engage the ships of the enemy, of equal force, on equal terms,—both being, as it were, batteries *à fleur d'eau*; whereas coast batteries, having a certain command over the sea-level, always—like the Telegraph and Wasp batteries at the bombardment of Sevastopol, on the 17th October, 1854—engage the ships of the invaders with advantage. But block ships, dismantled of masts and rigging, might be appropriated as fixed batteries at moorings, or as moveable steam-ship batteries, to protect channels leading to our great seaports, such as Liverpool, &c., provided they were furnished, at the expense of the shipping and mercantile communities, with local volunteer gunners—for the instruction of whom naval officers and gunners would be furnished by the Admiralty. These ships might be manned by land-men, and thus their sea-going crews would become available for the ocean fleets. Gunboats might likewise be employed in shallow waters, in large harbours and the channels of our principal ports—such as Portsmouth, Plymouth, and others—without detracting materially from the great object of manning the Channel fleet; but gunboats, except in the event of the fleet having sustained an unsuccessful action with that of the enemy at sea, would be of no use in protecting open and exposed lines of coast. (See Art. 258).

218. Our friends of the United States, in their 'Report on National Defences,' lay down the principle, that all assailable points on the coast should be guarded by

forts and land batteries; so as to leave all the naval forces of the country available for naval operations. "Forts," they say, "can be made impregnable against any naval force that can be brought against them, and are needed for the protection of the fleets while preparing for service on the ocean: the substitution of floating batteries for land defences would be to employ batteries formed of perishable materials, which might be inefficient when sudden danger menaces; their value, if in perfect order when wanted, ceases as soon as the occasion which called them forth no longer exists, and their speedy decay is certain. If we rely for the defence of our coast on our naval force, our means of protecting our foreign commerce must, by so much, be absorbed. To employ, therefore, our active navy, in whole or in part, for the defence of our coasts, instead of strengthening our fortifications, and constructing new ones, would be to supplant impregnable bulwarks by perishable ones—a fixed security by a changeable one; and it would be to expose ourselves to the chances of being suddenly left for a time without adequate defence. We should resign our sense of security, and our competence of safety; we should divert our navy from its highest duty, deprive it of its chief honour, and its chief claim to the respect and confidence of the people; and we should lose, by so much, the power of vindicating the national honour and our independence on the seas."

219. Steam-ram ships, as proposed by Admiral Sartorius, endowed with great power of speed, would undoubtedly be of great use in preventing a landing. They should not attempt to charge line-of-battle ships; but should, as they might, charge through and overrun, one after another, any number of comparatively slight transports—each having, perhaps, 1500 or 2000 troops on board: and a considerable number of these very formidable monsters should be provided accordingly. But the author has great misgivings as to the destructive effects which so enormous a shock as running butt at a large ship would produce upon the

ram. Exclusive of the effects that such collision might produce upon the ram-ship, by the fouling of its screw amongst the floating wreck of the vessel so run into, there remains one most important, and, perhaps, vital evil, which has not hitherto been considered. It is, that the vis-viva of an engine, weighing, with its appurtenances, 800 or 1000 tons—carried forward in a ship moving at the rate of, it is said, fourteen or fifteen knots per hour—being suddenly arrested by the stoppage of the ram when the collision takes place, would cause a shock so enormous that, in the recoil, any ordinary fastenings by which the engine is attached to the ship must be torn asunder, the whole of the internal machinery dislocated, and, by the dispersion of the contents of the furnaces, the ram itself set on fire.

All know the effects produced when ships in motion are suddenly brought to a state of rest by accidental collisions: persons are thrown out of their berths, and everything moveable is thrown forward with prodigious force. And it may be added, that, as the explosion of Armstrong's percussion shell is effected by the force with which the internal *striker* is thrown forward, when disengaged from its retaining bolt by the force of the impact, so would the whole internal machinery of the steam-ram be thrown forward, overturned, and scattered about, unless retained in its place by fastenings capable of resisting a momentum greater than that of the machinery, including boilers, furnaces, &c., at the moment of impact.

The author would, therefore, submit that this project should be tried on a real service scale, by running a floating battery—well strengthened at the bow, and covered with iron—direct at the broadside of a line-of-battle hulk, brought down to her load-waterline by being sufficiently loaded. No men should be on board of the hulk; and, during the charge—which should be made at full speed—a couple of men only should be left on board the ram or floating battery, in order to steer her; a boat being towed astern to enable the men to leave

her before the impact takes place. It would be better thus to destroy two ships, in making the experiment, than to leave the project to be tried on actual service, after some expensive ram-ships may have been constructed; which ships may fail to accomplish the purpose for which they have been designed.

220. To establish fixed batteries all along the contour of the island of Great Britain would be a great misapplication of our limited military means, if even it were possible. By this equalization of our strength everywhere, our coast would be uniformly weak, and be nowhere strong; and this, together with the fortification of many internal points requiring numerous garrisons, would leave a very insignificant force available for an army in the field, (see Art. 193). And, if we should carry that system so far as many writers have proposed, we should assuredly be beaten in a defensive war of posts and places, in detail. Forts and fixed batteries there must be, to defend and protect our principal commercial ports, towns, and harbours. To man those defences with regular artillerymen would absorb our artillery force so much as to disable us from properly providing for the defence of our Royal Dockyards, Arsenal, and Harbours; and from providing gunners for the very large artillery force there must be with the army in the field.

221. When the day of trial—by naval combat on the ocean, with fleets of nearly equal force—shall come, the issue will depend on that one of the opposing admirals who shall manifest superior skill in manœuvring, and on that fleet which shall be most exercised in the new formations and evolutions required in steam warfare on the ocean. The author does not pretend, in his recent work on that subject,^a to have laid down a complete code of such evolutions; but he takes the liberty of stating, that many high naval authorities have acknowledged that he has propounded in that work the true principles on which such a code should

^a 'Naval Warfare with Steam.'

be formed : the same authorities have honoured his labours so far as to express their opinion that copies of the work above indicated, as well as a copy of his 'Naval Gunnery,' should be supplied to all ships in commission in the British navy, for the information and study of the officers—the Admiralty, as a body, being by no means committed to the adoption of all, or any, of the suggestions therein contained.

The recommendation of a distinguished Admiral, to this effect, has not however been acted upon. There may be little in recent works worthy of the notice of the Admiralty; but the author cannot help observing, that the French do not appear to think so. They have discovered in them things worthy of being tried, and, when found useful, they have adopted and, occasionally, improved upon them, giving them a French designation; this was the case, for example, with what they call the *charge simultanée* in gunnery (see 'Naval Gunnery,' arts. 408 *et seq.*, 4th edition).*

Many of our naval officers of the old school object to the introduction of the *échelon* formation, in naval tactics, as impracticable; yet a distinguished French Admiral, Count Bouet Villaumez, has stated in his able work, '*Batailles sur Terre et sur Mer*,' that evolutions, not hitherto considered as naval—particularly *échelon* movements and formations—will now be introduced in warfare on the ocean. Such movements are difficult in execution, but this objection may be at once obviated by making them the subject of frequent and sedulous practice; both officers and men will thus be quite familiarized with them, and become capable of exercising them with all necessary facility. The French continually put such movements in practice in their squadrons of evolution; and, if we neglect to

* Had a war broken out in 1840, and a conflict between the British and French fleets ensued, we should have felt, perhaps most seriously, the effects of a practice (*la charge simultanée*) suggested many years since by the author, adopted, subsequently, by the naval authorities of this country as a French invention, and actually considered as such till the author's claim to priority was pointed out, which was after it might have been put in use against us.

do the like, we shall incur the risk of being defeated in an action at sea, through inferior tactical skill, even should our fleet be equal in force to that of the enemy.

222. The first alarm excited in England, on the subject of invasion, took place in 1795, when the Duke of York's army was compelled to retire from the Low Countries, and to return to England. In August of that year the author was sent to Teignmouth Castle, to take command of the artillery in the northern district; and, the day after his arrival, he waited upon the general-officer commanding in the northern district, the late General Nesbit Balfour, and presented to him a state of the artillery detachment. It consisted of one subaltern (the author), two sergeants, four corporals, and thirty 1st and 2nd gunners; a non-commissioned officer and three gunners at Sunderland; the like number at Hartlepool, and a detachment of invalid artillery at Berwick. The General said he had made urgent requisitions for a large addition to the artillery in the northern district, but was told that it could not be supplied. There were then only five battalions of artillery in the British service. The author proposed, thereupon, that detachments from every regiment in the district, each consisting of a subaltern and thirty privates, should be sent to Tynemouth Castle, there to be drilled to the service of two field-guns for each detachment. This was done, first with two, and afterwards with several detachments in succession; so that each regiment had its two battalion-guns, according to the system which then existed. But in Tynemouth Castle, Clifford's Fort, and the Low light battery which commanded, by a raking fire, the entrance to the river Tyne, there were fifty or sixty heavy guns in battery, which it was utterly impossible to man, and which, apparently, had not been used for many years, excepting in firing salutes by the artillery detachment. How were they to be manned? The author proposed to the General, that a meeting should be called of the merchants, ship-owners, ship-builders, and other members of that public-spirited community,



occasions in which the author—still an artillery officer—was concerned with the preparations making in England to resist invasion, were in 1802, 1803, and 1804.

The late General Congreve—the father of the rocket Congreve,* was employed, in 1803, to prepare, for field service, a large equipment of field-artillery, of a description proposed by him, and of which he invested the author with the organization and command. It consisted of ordnance of a peculiar description; and, although imperfect in many respects, it was of greater calibre than any had been theretofore used in the field, with the exception of the heavy 8-inch howitzer. The General's plan was to employ 8-inch mortars, which might be used either at high elevations as mortars, or in horizontal shell-firing as howitzers. Each of these pieces of ordnance was mounted on the body of the new pattern ammunition waggon. (See the illustrations on opposite page.) The ammunition boxes being removed, and the carriage unlimbered, the mortar on its bed was easily drawn up an inclined plane formed by strong planks, this plane and the block-trail making equal angles with the ground. To mount the mortar on the body of the waggon, the tail-block of a tackle was hooked to a ring fixed in the breast of the mortar-bed, the other block hooked to the point of the iron half-axle-tree upon which the ammunition waggons carried each a spare wheel. With this purchase, the mortar was drawn up the inclined plane, by hooking the traces of one horse to the end of the tackle-fall, and, the mortar being wedged and lashed in its place, the carriage was limbered up and ready to move. The bend in the tackle-fall, shown in the figure, is produced by the pressure of a bar laid across the fall, in order to render the line of draught horizontal, and prevent the collar

* The service is indebted to General Congreve for the block-trail gun-carriages, and for the waggons in which two horses were yoked a-breast, with mounted drivers. Before his time, horses were yoked in teams, in single draught, with a shaft-horse, the driver—who wore a smockfrock—being on foot; and both horses and drivers were procured by contract.

from choking the horse. In a short time, the gunners became so expert in these operations that they really were performed nearly as quick as limbering up a gun. Two gunners were mounted on the limbers of the mortar, and two on each ammunition cart, occasionally, when in march.

Thus was formed a moveable mortar or howitzer-battery, of twenty 8-inch ordnance, which might be moved with as much facility as any field battery: and it may be observed here that 10-inch mortars might, with advantage, be substituted for the 8-inch ordnance; their weight is only 12 cwt., which is less than that of a 9-pounder gun.

The author conceives that mortars thus mounted would be valuable substitutes for the 8-inch howitzer, which had become obsolete for field-service on account of the block-trail carriage not admitting of the howitzer being fired at high elevations. The carriage above described restores to the 8-inch howitzer the faculty of being used as a mortar.

Nine sea-service hand-grenades might be discharged from each mortar, with considerable effect, at short distances, and fall within a circuit not larger than that of an ordinary redoubt, or within the space occupied by a body of troops in mass. Each mortar-carriage was drawn by six horses; each mortar, and each of three ammunition carts per mortar, by four horses; each cart carrying forty 8-inch shells. Of these mortars there were 20, with a battery of field-guns attached, and waggons conveying intrenching tools, mining implements, and appliances for destroying bridges; besides others conveying trough-bridges, and materials for crossing ditches, rivulets, or other impediments of moderate width.

The instructions, drawn up by General Congreve for the use and management of this large equipment, enlightened the author much as to the principles on which a force consisting of regular troops, in combination with mortars or howitzers, should act, to dispute the advance of the enemy on the great roads, or in an open country; and also, as to the uses which should be made of light

infantry in defending every ditch, hedge, village, or other locality capable of allowing a protracted resistance to be made. During the day, 8-inch mortars, whose shells range 1800 or 2000 yards, should act on the masses of the enemy, without interfering with the defending troops. When, after the fatigues of the day, the enemy halts in mass for the night, an 8-inch shell should every minute fall in his bivouac; whilst light infantry should swarm round him and keep up a continual fire, driving in his advanced posts, and should make every possible effort to disquiet and harass his troops. At daylight, the enemy should be vigorously attacked by all the troops in position: and this resistance should be incessant, so that every inch of ground may be disputed. The author was taught this lesson by General Congreve, and he conceives that it is very worthy of being given in this work.

224. By roads and railways, extending along the most vulnerable parts of our coast, for the convenience of bringing up troops, and the establishment of moveable batteries at any menaced point, a vast increase of strength is obtained. If there were a railway along the coasts of Kent and Sussex, the benefit would be equivalent to an addition of 50,000 men to the army. Dover is a great fortress; and, by the defences on the western heights, it may be considered as a vast intrenched camp, which, if not directly attacked, could send succour to Deal and Sandwich, and in the other direction, by railway, to Folkestone. There is at present no railway towards Sussex, except that through Ashford to Winchelsea. It is, therefore, of vast importance that the railway from Dover should be carried on from the Upper Station at Folkestone, by a new line of rails, running eastward, along the face of the camp-ground at Shorncliffe, tunnelling where necessary, and falling into the Hythe road, at the mouth of the Seabrooke valley; or that a branch, from any part of the line near the camp at Shorncliffe, should pass by the valley of Saltwood to Hythe; from thence running along the military road behind the canal for nearly ten miles,

crossing the latter at Ham Street, and continuing on to Rye and Hastings, from which there is a coast railway to Portsmouth and Southampton.

When the late Duke of Wellington visited the coast defences—on the alarm of an invasion soon after the accession of Louis Napoleon, the present Emperor of France, to the Presidency—His Grace, being at Seabrooke between Sandgate and Hythe, conversing with his staff and the other officers, the principles of permanent camps and other fixed defences became the subject of discussion: when the Duke used the following expressions. “Look at those splendid heights all along this coast:—give me communications which admit of rapid flank movement along those heights, and I might set anything at defiance.” The saying is akin to the well-known expression of the illustrious Captain:—“I always felt as if I could go anywhere and do anything with that Peninsular army.”

In order to concentrate troops on any part of the coast, by railways from the interior of the country, and also to convey moveable batteries along the coast, convenient arrangements should be made, such as providing fit boxes for the horses, and trucks for the artillery, the latter so constructed as to admit of the guns being shot off on both sides of the line, throughout the whole length of the train; and power should be given by law, in the event of invasion, or the menace of an invasion, to lay an embargo on all the locomotive lines in the country which may become available for military movements.

The Channel Islands form the advance-guard for the protection of England from an attack from Cherbourg. They should be strongly garrisoned, and have a powerful steam squadron in their harbours.

The coasts of Essex and Suffolk are not so well provided with roads and railways as those of Kent and Sussex, and such communications should be prepared accordingly. And all the arrangements which have been described for opposing a landing in, and an advance through Kent or Sussex, should, in principle,

be adopted against an advance on the left bank of the Thames. Stations of troops should be *échelonnés* at convenient points. Positions should be reconnoitred and intrenched, upon which to fall back in succession, in order to cover the capital. A commodious steam ferry by rafts should be established between Gravesend and Tilbury Fort: each *flat* capable of transporting 1,000 men at a trip; so that all the disposable force on either bank of the river might be passed to that which is attacked, in order to intercept the invaders' communication with the sea, if they have, without due precautions, advanced into the interior: whilst all the troops stationed near the capital should unite with those first opposed to the invaders, on either side of them—to effect which anywhere there would be no difficulty. The forces of Kent and Essex united, and greatly strengthened by the resources on which they had fallen back, would be enabled to act with vigour against the enemy, who, being harassed on the flanks and rear by the irregular levies which would be brought against him during his advance, would scarcely risk a general action; and, should he rashly make the attempt, there would be little doubt about the issue of the unequal contest.

225. Our naval arsenals on the coast require to be strengthened by additional works; and the efforts which are now being made, to accomplish this end, ought immediately to be carried out as far as is consistent with our power of adequately manning the fortifications when completed. In thus fortifying our arsenals, harbours, and ports, there should be adopted no untried project of fortification, however plausible, requiring, in order to secure it from being taken by assault, a very strong garrison—which it would be necessary to withdraw from the force in the field. Such projects have arisen out of the Carnot system, the fallacies of which the author has endeavoured to detect and refute. The frontier towns of a great continental nation must be elaborately fortified, and provided with very numerous garrisons, in order to enable them to make

the most protracted resistance possible. But our naval arsenals, which are the frontier fortresses of our sea-girt isle, do not require such protracted powers of resistance; and to defend them would absorb too great a portion of our military resources. It would, indeed, fare badly with England, if, within less time than would be required for the enemy to reduce one of her fortified arsenals, her army, acting in the field, could not compel him to raise the siege, and drive his forces into the sea. Let it be added here, that no appeals from open towns, baronial residences, or any other quarter, for succours to be detached from the main army, should be listened to: the defence of such posts must be left to the local troops, and to the inhabitants themselves. Occasional evils may occur from such a policy; but a victorious army in the field would soon retrieve the partial misfortune: while to weaken the army by sending detachments from it, might be productive of the most serious disasters, and imperil the safety or independence of the country.

The only position that should be strongly fortified is the great central arsenal; but, as that cannot be executed till half the island shall have been overrun, so it need not be fully garrisoned unless adverse circumstances require it to serve as a place of refuge till other forces come up.

226. If an invasion of this country, from the opposite side of the Channel, should be attempted on two lines of operation—from Brest and Cherbourg, for example—the concurrence of these lines might indicate the intention of making a landing, if possible, in Torbay; and, in this case, Plymouth would be the immediate object of attack: or, should the point of convergence be the western part of the coast of Sussex, Portsmouth would be the place menaced. If the points of departure were further eastward, Sheerness, Chatham, Purfleet, Woolwich and London, might be aimed at. In this case, two landings might be attempted—one on the coast of Kent, and the other on that of Essex; and from these, advances might be made simultaneously on both sides of the

Thames : that on the left bank, to get possession of Tilbury and Purfleet ; while the force on the right bank would aim at the capture and destruction of the dockyard and arsenal at Woolwich—from this last the enemy would be plentifully supplied with the materials for bombarding and destroying the capital.

It is a well-established maxim in military science, that if, in invading a country, crossing a river, or storming a breach, the enemy can once get a footing and form a lodgment on the coast, the further side of the river, or on the breach—and proper measures be adopted to support, extend, and make good that lodgment—it is no easy matter to dislodge the assailants in either of these cases. The most strenuous exertions must therefore be made, in repelling an invasion, to prevent the enemy from gaining a footing and establishing a lodgment on our coast. This will, of course, depend upon the number and quality of the troops which may be concentrated upon the menaced point. In former times, a concentration of the defenders in force upon any point of the coast, in order to oppose an attempt of the enemy to land, could only be effected by the slow process of marching to the spot. But this limitation of the movement of troops to the physical capabilities of man no longer exists. If good strategical combinations be made, and all the resources of locomotion by railway be employed by the Government, the author ventures to express his firm conviction that no invaders will ever obtain a footing, or make good a lodgment on the shores of Britain.

The employment of steam is supposed to have bridged the channel which separates us from our powerful neighbour, and to have facilitated, on that account, the operation of making a descent on the shores of this country : this opinion, whether well or ill founded, has produced in some minds a certain degree of anxiety, with respect to the possible results of an attempt at invasion ; but the author trusts he shall be able to show that no such feeling need exist. The Armstrong gun, and other rifle cannon of long range, will afford the

defenders of the country a vast advantage, in keeping, by their fire, the ships of the invaders at a great distance from the shore; and, independently of these, the pretended steam-bridge must necessarily terminate where the water becomes too shallow for ships of war, and transports having a considerable draught of water, to float.

The form of a coast has great influence on the success of a landing of troops by open force and in face of an enemy. On low coasts—such as Romney Marsh—the beaches are not steep, the tidal currents, or rather eddies, are weak, and the water is shallow to a considerable distance at sea: so that ships would be unable to approach near the shore, and the boats conveying the troops to land would have great distances to row, under a most destructive fire from the fixed or moveable batteries which are to oppose the debarkation; which, moreover, can only take place at the top of high-water—a limitation as to time which is very disadvantageous to the invaders.

A gently sloping beach indicates that the land is gaining on the sea, and offers facilities for obtaining a footing on the shore; but, even here, the downs or hills of shingle thrown up by the waves in gales of wind, often considerably above high-water mark, afford behind them some cover from the fire of the ships, for the troops, who should be stationed there in order to spring upon the enemy when in the act of landing.

On the other hand, when the land is high, and the beach abrupt, ships may get near, and the boats would have a short distance to be rowed; but here the tidal currents are so strong that row-boats will scarcely be able to stem them, or keep in due order. A steep shore indicates an encroachment of the sea on the land, and, in this case, a range of high ground is not far behind, which will afford commanding positions for the main body of the defenders, who, from thence, on whatever part of the beach in front the invaders may attempt to disembark, can see all their movements; and, should

these succeed in effecting a landing, may bring them with advantage to a general action.

An invading force will scarcely venture to land in a small bay, subject to the crossing fires of batteries placed on the promontories between which it is contained. The effort would, more probably, be made in a capacious bay whose capes are remote from each other, or on a straight line of beach, where the landing might be protected by converging fires from the ships on both flanks. All such headlands should therefore be protected by strong forts, and by flanking batteries at convenient points along the coast, as well as by troops on commanding ground in the neighbourhood. These should not be stationary intrenched camps, but in situations which will permit movements to be made to the right or left, where strong natural positions may be occupied, from whence, in whatever direction the enemy's advance may be made, he may be met by a superior force, (see Art. 224, p. 215).

Great discretion must be used in the disposition of the troops brought down to oppose the landing. The amount of force to be engaged should, as much as possible, be concealed from the invaders; the troops who are immediately to resist the landing should be concentrated near the shore, under cover, before daylight in the morning; the officers should be furnished with good topographical sketches, showing every feature of the ground, that they may be enabled to take advantage of the eminences or hollows, for the purpose of deceiving the enemy with respect to the numerical strength of the force he will have to encounter on landing.

Where steam ceases to be useful to the invaders, it becomes most so to the defenders of the country; who, during the whole time that the operation of attempting to land is being made, will, warned by the electric telegram, be employed in bringing up, at the maximum of railway speed, all the active forces in that part of the country, and concentrating them on the menaced point.

Thus, if steam power facilitate, as it no doubt will, the passage of a fleet of ships across the Channel, it must be remembered that the like agent on land will give to the defenders of the country—if properly taken advantage of—prodigious power of concentrating their forces during the long time that a landing of the invaders is being effected in open row-boats, subject to the action of strong tides and other impediments on the coast. Besides this power of concentration at a point of debarkation, steam gives to England immense advantages in the interior of the country, where every railway station is a strategical point, and every railroad a strategical line, on which, at the first notice of invasion, the electric wire will set in motion the whole disposable force of the country, in conformity to preconcerted arrangements, so that the bodies of troops may follow and support one another, while all are directed to the threatened point: therefore, though, as this case supposes, the invaders may have a temporary command at sea, yet our cruisers can easily report, by signals, the course on which the enemy's fleet is steering, and, consequently, the part of the coast to which it is tending.

When the invading troops are in the boats, and the landing is about to be attempted, the fire of the ships covering the landing must necessarily cease when masked by the debarking troops; the defenders should then advance in quick succession to oppose the enemy at the point of the bayonet, the men fighting, if necessary, up to their knees in the water. Should the invaders gain firm ground, they may be charged by cavalry at that moment of weakness when the squads of men landed from the boats are at very open order, in consequence of the line of boats from which they issue being of far greater extent than that which the troops occupy when formed in line, and before they can form, load, and concentrate upon the respective centres of regiments. The invaders will bring on shore *chevaux de frise* (see Art. 213, note, p. 200), which they will endeavour to place in their front, in order to protect them against such a charge: in this case, the defenders should

immediately rush forward and remove them, or, taking post behind them, convert what was intended for a protection to the invaders into an obstacle to their advance. Everything should be done to create and keep up a *melée* on the beach by a hand-to-hand fight with *armes blanches* as long as possible, to prevent the fire of the covering ships from impeding the formations of the defending troops on the neighbouring heights; and, in such *melées*, arms in the hands of the stalwart peasants of England would effect as much against the enemy as those in the hands of regular soldiers.

By the recent improvements in artillery, we are now furnished with powerful guns, with which we may reach an enemy at great distances; and the author is of opinion that 8 and 10 inch mortars, mounted on travelling carriages, and capable of being used for firing shells at high elevations or horizontally, may be very advantageously employed against an attempt of an enemy to effect a landing on our coast. They may be used, first, as mortars against the crowded ships of war and transports constituting an invading armada; then, as the numerous boats filled with troops advance towards the shore, by diminishing the elevation of the pieces, and, without intermitting the fire, they may be used as howitzers to project shells, and subsequently sea-service grenades; and, finally, to sweep the surface of the sea with grape-shot till the moment of landing. The mortars might be laid on the beach near the water's edge, and their fire should be combined with that of troops placed to prevent the enemy from gaining a footing on the shore. This at least is the way in which the author determined to use such artillery, had the enemy afforded the opportunity in 1803.

It should be borne in mind that, in such circumstances, the last few discharges of the artillery are the most destructive to the enemy: therefore the mortars should remain in their position till the last moment; if captured by the enemy, they would be of no immediate use to him provided the carriages and ammu-

nition were withdrawn. Should the enemy be driven back to his boats, the mortars would be ready promptly to open their fire upon the row-boats again crowded with troops, and would inflict upon the enemy such a loss as would probably deter him from repeating the attempt. No field-guns should be risked in this manner till the last moment, for, should they be captured by the enemy when he has made good a landing, they would become a valuable acquisition to him by putting him in possession of an arm in which he may be presumed to be deficient.

Mortars ceased to be in general use both for the land and sea service subsequently to the period to which the author refers; but it has been recently discovered, by sad experience, that a great error has, in this respect, been committed: mortars are now coming into use both for the sea and land service, and the author has little doubt they will hereafter be much used as a field artillery. General Radetzky brought some mortars into the field in 1848, and they were found to render effectual service during his campaign in the North of Italy.

If the strategical arrangements for the concentration of troops upon the coast be properly conducted, and Britons act with the vigour and persistence congenial to them, it is scarcely possible that the invaders should succeed in obtaining a footing on the soil of this country. Practicable breaches made in the ramparts of fortresses—as at Badajos, Burgos and St. Sebastian—have been defended so as to resist attempts made by the best troops in the world to take them by storm; and the shores of Britain will, if proper measures be taken, be in like manner inexpugnable by any hostile force.

The measures necessary to oppose the advance of the invaders into the interior of the country, and drive all who do not lay down their arms into the sea, will be the subject of a separate, and, for obvious reasons, a confidential paper.

227. However quickly the operation of transferring

troops from the transports to the boats which are to convey them to the shore may be performed, there must always elapse—from the time that the armada comes in sight, and the invader, by casting anchor, makes manifest his intention—a considerable interval before the landing can be effected, during which the preparations for opposing him may be completed. The landing of the British army, under the command of Sir Ralph Abercrombie, in Egypt, in 1801, affords an example of the manner in which a debarkation on an enemy's coast may be effected.

The British Fleet, with 15,000 infantry and 472 cavalry on board the ships, anchored on the 1st of March in Aboukir Bay; but, the state of the weather having been unpropitious, the landing did not take place till the morning of the 8th, when the first division embarked in 150 flat-bottomed boats, each containing 50 men, the whole formed in line.

The French—who were formed on the heights, about 2,000 strong—allowed the boats to approach to within easy range, and then opened a heavy fire on them; by which several were sunk, and severe loss was experienced by their crews: notwithstanding this, the line of boats pushed on with such precision that their prows struck the sand at the same moment; when the troops instantly jumped out, and—the enemy having neglected the precaution of having a body of troops on the shore to oppose the landing—the 42nd, 23rd and 40th regiments rushed up the heights with fixed bayonets, and carried them in the most gallant style, with the loss however, in all, of 500 killed and wounded.

The invasion of the Crimea, in 1854, can scarcely be considered a case of forcing a landing in presence of an enemy, when we find that the first persons on shore were a French boat's crew, containing half a dozen men; that a single corps of troops landed at about 9 A.M.; that several General Officers and their staffs arrived before any considerable number of troops were on shore; and that the enemy never attempted to disturb the operations in any way. The subsequent landing of the

troops was, after some delay occasioned by want of boats, well conducted and rapidly effected. By 3 P.M. on the same day, about 14,000 British troops, with 12 guns, and 22,000 French infantry, with 53 guns, landed. But an open demonstration had been made, for several days, of an intention to land somewhere on the beach; and such demonstration to attempt a landing, if made against any other country, and particularly England, covered with a network of railways, would have afforded time to concentrate upon the menaced point a force three or four times larger than any that could be landed at the same time, however great the force of the invaders' armada might be.

228. The only experience the author has had of the operation of landing on shore in face of an enemy, was in the expedition to Walcheren, in 1809, when he, as Assistant Quartermaster-General of the forces, was charged by the Quartermaster-General, Sir Robert Brownrigg, to conduct the duties of his department in that operation. The landing took place exactly in the manner practised in Aboukir Bay, in 1801; and was feebly opposed by troops sent from Flushing, and by the fire of the Den Hak Battery. There, also, our intention to land at that place was made evident during two whole days previously; which would have afforded ample time to assemble on the coast of England a force far greater than that which actually disembarked, which consisted of a portion only of the troops employed in that expedition.

229. What to do with respect to Woolwich Arsenal, is a question of very great difficulty. That arsenal has grown up fortuitously, and has become a monstrous evil, which cannot be abated, but must be cured. It is a vast *entrepôt* in which have been collected, during many years, prodigious quantities of both naval and military ordnance, and stores of every description. The idea of fortifying Woolwich is too extravagant to be admitted. A high authority in military engineering has observed, that the works which would be requisite to cover the arsenal and dockyard should

occupy several remote and extensive heights, which command it, and extend to both sides of the Thames, in order that the stores and machinery may be beyond the range of the rifle artillery of the present day; and the money which would be expended in constructing and arming the works, would be much better applied in other ways for the national defence. It is much more consistent with the circumstances of this country, to employ its resources in raising men than in building extensive fortifications, the garrisons of which would absorb our whole army, and oblige us to be always acting on the defensive, (see Art. 193, p. 181).

The vicinity of Woolwich to London renders it highly probable that this great arsenal, if strongly fortified, would not be attacked till after the metropolis were occupied by the enemy: in which case, a lengthened defence of the position would be unavailing.

Two great objects would indeed—if the place were not fortified—induce the enemy to advance in that direction: namely, to take and destroy the only arsenal we possess; and, with the abundant means which the enemy would find in that undefended place, to attack, bombard, and destroy the capital, and any other place in that part of the country. He would be under no necessity of bringing with him any heavy artillery, projectiles, ammunition, or stores: he would there find a plentiful supply of everything needful for carrying on his operations against the capital, or in the country. The position and security of an arsenal are the cardinal points on which the defence, active or passive, of a country can be organized; and our only arsenal, instead of being behind the capital, is in front of it—in an advanced, exposed, defenceless, and indefensible position.

In consequence of measures recently taken by the Government, Woolwich, besides being our only arsenal, has become a vast foundry, and a manufactory of all descriptions of arms and warlike implements; and, particularly, it is a vast establishment for the manufac-

ture of the Armstrong and Lancaster guns, shells, &c. This is apparently in opposition to every military opinion, which is in favour of forming such an establishment in some central part of England, where it would be far distant from the first line of operation of an invading army. The expense of removing the establishment, as it exists at present, would be so great that it may be feared that the Chancellor of the Exchequer will not be willing to incur it; yet this must be done, at any cost, if the immense materials deposited in that arsenal are to be preserved from the destruction which would await them on the approach of an enemy to the vicinity of the capital.

The naval ordnance and stores might be removed to the naval arsenals; these would be adequate to furnish supplies for the number of ships that may there be built, fitted and refitted, without being encumbered with more of ordnance and stores than are necessary. All the ordnance which has been accumulating for ages at Woolwich, and which has become obsolete, should be sold by auction, on condition of being immediately removed.

The Royal Dockyard at Woolwich cannot, indeed, be removed; and it may be burnt by an enemy proceeding so far; but when the Royal Arsenal is broken up, an enemy will find no military stores at Woolwich, to be used in offensive movements against the capital or elsewhere.

230. The most important and absolutely indispensable measure of forming a central Arsenal should be commenced forthwith at Weedon, or some other central point or points from which railways radiate in every direction, and afford a direct communication with London. Such a position, no doubt, should be selected, and preparations made to receive there, in buildings erected for the purpose, the machinery employed in the carriage department, and all the other establishments which now exist at Woolwich: no new iron ordnance should be sent to this last place; it may be, far more conveniently, sent at once to the

new central dépôt, and a proof-butt may be erected there. Shoeburyness may still continue to be the practice-ground for testing the ranges, &c., of new ordnance: these, never being very numerous, might be withdrawn; or, together with all the ammunition or stores at that part of the river, be destroyed, if needful.

When Woolwich Warren ceases to be an artillery arsenal, it should no longer be the head-quarters of the artillery corps. That vast corps is now far too great to retain, practically, its unity. There should be, as in France, several land-service artillery arsenals, with an artillery head-quarter at each. Resolving, thus, that huge corps into several portions, would conform, in principle, with the re-organization of the artillery which has lately been made.

231. Let it be supposed that a fleet of ships of war and transports—having on board a force, in men and stores, presumed to be sufficient for the conquest of these islands—has, by some favouring circumstances, been able to elude the vigilance of the British Channel Fleet, and has arrived, unmolested, at our shores. Let it be supposed, moreover, that, under the protection of its own fleet, the invading army has effected a landing on our soil. Improbable as it may appear, that the whole Channel Fleet of Great Britain should be drawn or forced away from the point of disembarkation, let this pass; and let us come to the important question,—In what manner may the army of the invaders be best opposed on British ground? Various projects, for the defence of England in the event of invasion, have, during the last eighty years, been offered by distinguished military men; and notices of these were given by Colonel Adair, of the Suffolk Artillery, in a lecture delivered at the United Service Institution, in June, 1858. The nature of the several projects may be understood by reference to the works quoted at the end of the paper containing a notice of the gallant Colonel's interesting lecture, in the 'Journal' of that institution for January of the present year, 1859. It will be sufficient,

here, to give the following brief outlines of only two or three of the proposed plans of defence.

232. General Lloyd assumes a landing of the enemy on the south-west coast of England; and proposes to resist the invasion by three army corps, between the place of disembarkation and the metropolis. Lieut.-General Birch supposes that the invasion might take place simultaneously on the east, west, and south coasts of England; and recommends that four strongly intrenched camps should be established, at spots where they may cross the enemy's lines of operation; with a fifth, in some central position—as at Rugby, or Warwick. General Roy's plan of defence, as extracted from his papers by Sir Harry Calvert, was limited to the south coast; and consisted in occupying, as military positions, the three nearly parallel ranges of heights between the English Channel and the metropolis. Again, Baron Maurice, supposing the enemy to select three points on the south coast as places of disembarkation,—Rye, the mouth of the Avon, and Plymouth; and, assuming that his movements will be simultaneously concentric on London; proposes to form intrenched camps about the metropolis, in order to cover it. Major-General Lewis, in his 'Notices on the Plan of Baron Maurice,' proposes that the landing, which he assumes will not take place westward of Hampshire, should be opposed by troops moving by the railways along the coast; and that a few places—as Ashford, Battle, Lewes, Shoreham, and Chichester—should be protected by works, merely strong enough to secure them against any desultory attack, and should be defended by the local militia or irregular troops: while three places—as Tunbridge-Wells, Balcomb, and the mouth of the Avon—should be fortified, so that each might withstand a regular siege, and should be garrisoned by troops of the line.

233. Colonel Adair proposes to make the railways about London available, as a zone of communication; and to form, in advance of them, a chain of military posts. It is probable, says the Colonel, that the main

body of the invading army would be accompanied by subsidiary expeditions, to be landed at different points on the coast of England: these various columns, he conceives, should be met by brigades of militia, organized on the several lines of operation. These might arrest the advance of the enemy on those lines, and might engage him in battles of position: the railways, parallel to the lines of battle, would serve for the communication of the defenders, in affording the different corps mutual support, and the others would serve to connect the lines of battle with the general base of operations.

But the principal object of Colonel Adair's lecture was, to show that the militia force of this country is capable of making an effective defence against an invading enemy. If this be understood to mean in co-operation with the regular army, the author is quite willing to subscribe to the correctness of the opinion. But, in the disposition which the Colonel proposes to make of the militia force for the defence of the country, he appears to consider that force as a feudal array of troops for local service: now it ceased to be such in the reign of George II., and at the present time it forms a valuable and indispensable auxiliary to the regular army, and should be brigaded with it accordingly. Sir John Burgoyne has well said, that militia regiments when first embodied are as little capable of taking the field, by themselves, as mere volunteers would be; and that, in every instance, they require the co-operation of, at least, an equal number of regular troops. It is admitted, however, that, after having done the duty of regular soldiers during about twelve months, they may arrive at a state of efficiency which will enable them to act with regular troops, in equal proportion—or, in the proportion of one of the former to two of the latter in each brigade. The corps of militia artillery may be appropriated to the service of the coast batteries. But, without the militia, in combination with our regular forces, we could not provide an army of sufficient force in the field to put in execution the essential

measures by which the capital may be covered, and England defended. It cannot be too strongly put, that, with such an army in the field, in addition to her other means of defence, England is safe; without it she would be in danger, whatever may be the amount of her irregular forces.

How, it may be asked, is the militia to acquire a sufficient degree of training to enable it to act with the regular army? Not, assuredly, by an annual training of twenty-eight days. That such qualification may be effectually obtained, portions of the militia troops, in rotation, should be embodied during periods of at least two years. Such embodiment can be effected, and it should be commenced as soon as the practice of enrolment by ballot shall have been restored; the force first called out being selected with a due regard to the peculiar circumstances of the present time. The objection to thus embodying portions of the militia for a two-years' training lies in the fact, that at first the regiments embodied would have to bring up their strength to the full establishment by voluntary enrolment, and they might thus enlist numbers of men whose names, if not changed, might be found on the rolls of disembodied regiments. The ballot would, however, inevitably make known the fact, and thus a stop would soon be put to such fraudulent practices; and, in a short time, the strength of the militia would be brought up to its estimated amount, (see Art. 258, p. 253).

234. Every means will have to be resorted to, which the nature of the country may afford, for impeding the advance of the invaders; such as dismantling the railways, rendering all the roads impassable, and, where possible, forming inundations on the rivers or canals; driving away cattle, and removing or destroying whatever might afford subsistence for the enemy on the lines of his march, as was done by the Russians when their country was invaded by the First Napoleon, in 1812. In these operations, the knowledge of the country which the officers and men of the local corps possess

will be of great value ; and the local soldiery will be the best defenders of the defiles and the stockaded posts, which it may be necessary to hold, for the purpose of checking the advance of the enemy.

In order to enable the militia to act efficiently in this kind of warfare, the light infantry regiments should be well trained to practice formations in open order, and the infantry battalions should be accustomed, in camps of instruction, to defend stockade works and lines of intrenchment.

235. The present camp of instruction at Aldershot is admirably situated for thus training the militia regiments embodied in that part of the country. The chain of heights, extending in a serpentine line from Finchampstead in Berkshire to Guildford in Surrey,—comprehending the wide plateaux of Easthampstead and Hartford Bridge, the Chobham and Farnham ridges, and the range of chalk-hills called the Hogsback,—constitute choice positions covering Windsor and the metropolis against an enemy coming from Hampshire and the south-western counties. This line, presenting numerous salient points, is capable of being fortified by field-works, disposed so as to defend one another and the ground about them ; and thus the whole position may be rendered a sort of Torres Vedras on a small scale. The attack and defence of this position would afford excellent training for the young soldiers, in that part of military service, while the plains in the neighbourhood afford ample ground for the manœuvres of large bodies of infantry and cavalry.

236. The great naval arsenals of this country—as Portsmouth and Plymouth—must be permanently fortified, as has been said ; but few inland towns will require other fortifications than such detached works as may render each place an intrenched position, in which the defenders, if unable to keep the field, may find protection till they receive reinforcements sufficient to enable them to return to active warfare ; and then, resuming the offensive, they should use every opportunity of acting upon the enemy's lines of communication, to

harass him, and interrupt the supplies which he should receive from his depôts.

237. The author has, hitherto, considered the defence of the country by its regular and militia troops only; and he purposes now to dwell for a moment on the vast means of defence which would be afforded by its levy *en masse* of the population, which, in the moment of national danger, would lend its aid to the Government in crushing, or repelling from the land, any intrusive army which may have succeeded in crossing the seas which separate these islands from the continent of Europe. There are distinguished military men among us who maintain that our sole dependence must be placed on our regular army, and that we should derive no benefit from an armed population; while there are some who contend that our regular army is too small in point of numbers to enable it to oppose the invaders in the field; and these persons would have us trust only to the desultory actions of the bands of volunteers, whom the love of their country would bring forth in time of need. The experience which the author acquired during the Peninsular War enables him, however, to assert with confidence, that neither the regular army nor the bands of volunteers, alone, would suffice to save the country from the ruin in which a successful invasion would result; and that, to obtain this end, both of these means of defence must be judiciously combined.

238. Those who, like the author, have witnessed the prodigious influence which the desultory warfare carried on by the people of Spain, without discipline and almost without arms—but supported by the gallant army under the Duke of Wellington—had in delivering that country from the invasion of their powerful neighbours, will not feel a doubt that the like desultory means employed in this country—in combination with and aided by the support of the regular troops and militia—will baffle any effort which may be made to subjugate it by a foreign army, however powerful that may be. The people of Spain, formed into small bands of partizans, under the

name of *guerillas*, animated by the love of their country, devoted themselves to the national cause; and, by their desultory warfare, disconcerted the scientific tactics of the armies of France, commanded by the most skilful marshals of Napoleon.

That great, but unscrupulous, commander being defeated, in that most just and retributive war, by the superior tactics of Wellington,—driven out of Spain by the combined operations of the British army and its Portuguese allies, and the heroic valour and patriotism of the Spanish people,—laid there the seeds of his own downfall. Stern justice then overtook and crushed the perfidious author of that iniquitous invasion. And, doubtless, no less signal would be the punishment of an unprovoked aggression, were it attempted, against a country,—the abode of peace and industry, the bulwark of constitutional liberty and sanctuary of freedom; such country being defended by a brave people, fully prepared to maintain to the last the independence of their fatherland.

239. Early in 1811, the author, then serving on the Staff in Spain, was—by the authority of the minister-at-war, the Earl of Liverpool, and the appointment of Lord Wellington—sent to the north of that country, to inspect and report upon the state of the armies of Galicia and the Asturias, and on the military resources of that part of the country—the only part then not wholly occupied by the French; also to report upon the best way in which those resources, regular and irregular, could be made available for carrying on the war; to ascertain to what extent the regular armies might be augmented; and whether or not the guerilla system, which had already become very formidable to the enemy, should be encouraged and extended. All the regular Spanish armies had at that time been defeated and dispersed at Tudela, Rio-Secco, Espinossa, Regnossa, &c.; and many of the dispersed soldiers had joined the guerillas, of whom, on that account, the officers of the Spanish regular army were jealous, and for whose suppression they used all their influence.

240. In these perambulations, through districts said to be occupied by the French—but of which they possessed only a few block-houses, redoubts, or fortified convents, as posts of refuge, which they had established—the author witnessed the prodigious effect of the uncompromising resistance of the people to the invaders, which constituted so remarkable a feature in that patriotic war. Though accompanied only by his aide-de-camp, one servant, and a Spanish dragoon, he was in no danger.

The French, if occupying towns, retired at night to their fortified posts; when the guerillas entered, to refresh and regale themselves among the town-folks. At daylight in the morning, the guerillas withdrew from the town; which the French then entered, and, during the day, associated with the people. But, in general, the French troops remained *renfermés dans leurs coquilles*.^a

The guerilla chief, Don Juan Sanchez, observing that the Governor of Ciudad Rodrigo was in the habit of taking an airing on horseback in the country, attended by a small escort, made arrangements for his capture, and carried him off prisoner, with all his attendants, in the sight of the place. And numerous other instances of this description occurred in the course of the war. When any officers of the French garrison, established in a city or town, were desirous of indulging in a shooting excursion, pickets of cavalry and infantry were sent out to form a complete line of sentries and videttes round the whole of the space upon which the party was to act, before the sportsmen dared proceed to the ground. A circumstance of this kind the author witnessed, when near Astorga.

241. Having seen and communicated largely with several of the guerilla corps, which were operating in localities overrun by the French—but who, herding

^a This expression is taken from an intercepted letter, written by a French officer of rank to his family.

together, commanded no portion of the country except that which they actually occupied—the author reported that it was of great importance to the success of the war that no regular corps should be formed, except such as could be paid, clothed, officered and properly equipped for field service; that, beyond this limit, the guerilla warfare should be stimulated as far as possible, and that the men should be provided with arms and ammunition from England. At this time, all the fortresses and great towns, even the capital itself, had been occupied without resistance; and the subjugation of the country, seemed to be complete, when an émeute at Madrid led to the sanguinary massacre of the 2nd of May, 1808. Intelligence of this event flew through the country; and, wherever it reached, the people rose simultaneously, and evinced a spirit of patriotism and independence which astonished all Europe. They sent deputations to England, to implore her aid: this was granted, and the Peninsular War commenced. “While these events were passing in Castile, Popham’s armament remained on the Biscay coast; and the partidas, thus encouraged, became so active, that, with the exception of Santona and Gueterin, all the littoral posts were abandoned by Caffarelli. Porlier, Renovalles, and Mendizabel—the nominal commanders of all the bands—immediately took possession of Castro, Santander, and even of Bilbao; and, though General Rouget came from Vittoria to recover the last, he was, after some sharp fighting, obliged to retire again to Durango. Meanwhile Reille, deluded by a rumour that Wellington was marching through the centre of Spain upon Zaragoza, abandoned several important outposts; Arragon, hitherto so tranquil, became unquiet, and all the northern provinces were ripe for insurrection against the French.”* Thus a great impulse was given to the guerilla warfare. Without the co-operation of

* ‘History of the War in the Peninsula, and in the South of France, from the year 1807 to the year 1814,’ by Colonel, now General, Sir W. F. P. Napier, C.B.; vol. v., p. 253.

these powerful auxiliaries, the army of Wellington might have been overmatched by a concentration of all the French forces in the field against him; but the two forces effected, conjointly, that great object which neither could have accomplished singly.

242. Cordially did the government of H. R. H. the Prince Regent approve and support the author's recommendations.

The Earl of Liverpool, in his despatch No. 11, of the 13th of December 1811, writes thus to the author:—

“Your reports of the activity and energy displayed by the guerillas in general, have been very gratifying: and the Prince Regent has read with particular pleasure the details of Colonel Mina's operations, and of his gallant achievements in Arragon.

“In consequence of your strong recommendations, that large supplies of arms and ammunition should be sent out immediately for the use of the North-Western provinces of Spain, there will be shipped without delay as large a quantity of small arms, ball-cartridges, powder, &c., as can be conveniently spared.”

243. The powerful effects of this impulse given to the guerilla warfare in the North of Spain were severely felt by the French, not only in those provinces, but in the convoys and all communications on the roads from Valladolid, Burgos and Vittoria, to Bayonne, being intercepted. And in the midst of those successful, and, for the enemy, demoralizing and distracting operations, there appeared, in the spring of the year 1812, a powerful British squadron on the north coast, which the author, in his despatch of the 15th of November 1811 to the Earl of Liverpool, recommended to have prepared with secrecy during the winter; and to be sent out six weeks or two months before the regular campaign of 1812 should open; the squadron to be provided with arms and ammunition in furtherance of the guerilla warfare. In a secret despatch addressed by the Earl of Liverpool to the author, dated May 12, 1812, his Lordship notified that Sir Home Popham had been appointed to the command of a squadron, having on

board a battalion of marines and a company of artillery, the object of which was to cruise on the north coast of Spain, to open a communication with the principal guerilla leaders in that part of the country, to endeavour to get possession of some post which might afford an entrance into Biscay, and might keep the French forces in a state of alarm by the menace of turning their positions, should they take up such behind the Ebro. The despatch concluded with a recommendation to the author to afford every assistance in his power to the expedition, to support any post which might be seized, and to supply with arms the guerillas in Navarre and Biscay.

In fact, large supplies of arms and ammunition were sent to the guerillas; which not only rendered it impossible that the French generals, commanding in the North of Spain, should send back to Marshal Marmont, for the opening of the campaign, that large portion of his army—consisting of infantry, artillery and cavalry—which he had sent there to be refreshed during the winter, but made, moreover, a powerful diversion in favour of the Earl of Wellington's operations.

Intercepted despatches prove how effectually this had been done. General Caffarelli writes to Marshal Marmont, 4th of June 1812:—"You hope to give battle to Wellington; I shall take to you 8000 infantry and 24 field-guns." And, on the 20th of June, Caffarelli writes to Marmont, that he was prevented doing so by the activity of the guerillas. Caffarelli adds,—“It is no longer with bands that I have to contend, but with corps of 3000 or 4000 men, which act under the English.”

Marmont wrote to General Caffarelli from Tordesillas, on the 2nd of July 1812,—“You promised me that you would send troops on the 10th of June, to succour me, and do all in your power, as a faithful servant of the Emperor, to send me reinforcements. On the 14th of June you gave me the same assurances. On the 20th of June you announced to me, that a part of the infantry would be retarded, from the causes you mentioned, but that the cavalry and infantry had com-

menced their march : and to-day, the 2nd of July, not a soldier, not a gun from the army of the North has arrived. I know not what will be the result ; but, if fatal, that it would not rest upon Marmont." In fact, 10,000 infantry, 24 guns, and 4000 cavalry, were happily kept off from Lord Wellington's hands, at the battle of Salamanca, through the operations of the Spanish irregular forces.

244. The following copy of a despatch from the Earl of Wellington to the Earl of Liverpool (see 'Wellington Despatches,' vol. ix. p. 319) shows, how powerful a diversion had been made in favour of His Lordship's operations, by the unexpected appearance of the British squadron on the north coast of Spain at that early period of the year :—

"I have not received detailed accounts of Commodore Sir Home Popham's operations on the coast since the capture of Lequeitio, but I understand that he has taken Castro Urdiales : and there is no doubt that those operations have drawn the enemy's attention to that quarter ; and that General Caffarelli has been able to detach only cavalry to the assistance of the enemy. From the advantage derived from these operations, your Lordship will form a judgment of that which would have been derived, under existing circumstances, from the expedition which had been concerted, and agreed upon, to the eastern coast of the Peninsula, with the troops from Sicily, combined with the Spanish troops in Majorca and at Alicante."

When Mina, and all the other guerilla chiefs in the north of Spain, had acquired distinction by their valour, gallantry, and patriotism, which had been so conspicuous, the author felt regret that there were not at his disposal swords and pistols superior in quality to the ordinary weapons furnished to the cavalry, which might be issued to those distinguished chiefs ; and, having submitted this to the consideration of the Earl of Liverpool, he received an answer, of which the following is an extract :—

"In conformity with your suggestions, an order has

Respectfully

June 2^d 1812

Dear Sir

I have received your
letter of the 29th in regard to
the letter I have written to the President
chief with the words & Pistols
I have presented them in my
name.

I have found that the
shortest & most simple mode of
expression is the most agreeable
- Wm. Lewis Edwards Dwyer, Junr -

of the Harmines, & has most effect,
and it appears that particularly
since the Assembly of the Estates
they have felt that they were to look
for their happiness in the welfare
=ance of their country rather than
in the internal institutions.

I therefore the letter is the
written I turn in my name
I request that they may be informed
that I obey with great satisfac-
=tion the commands of H. H.

The same Regent in transmitting
them these Presents as a mark
mark of the estimation in which
their conduct is held by his
Royal Highness & by H. M.
Subjects in general; in having
withstanding the Reverses of
all the Regular Armies in Spain,
the misfortunes of the Country,
and in the face of difficulties
of all descriptions continued to
maintain successfully the cause

of the burning. But I
having been employed by her Majesty
in the Peninsula since the
commencement of the contest
for the Independence of Nations
inhabiting this part of the world,
have been fully aware of the
difficulties of their situation, &
of the benefit which the cause
has derived from their constant
perseverance & valour; and
I trust that where

which their conduct has gained
for them what is now sent
them is a small token, the
consciousness that they have done
their duty ~~graciously~~, and
the hopes which there are now
good grounds for entertaining
that their labours & exertions
will be crowned by their
attainment of their object,
the independence & the
happiness of their country.

will be their inducement for
continuing & if possible
increasing their labours.

Ever Dear Sir

Yours most faithfully
L. A. Channing

been given for sending to Corunna some handsome arms, to be presented, on the part of the British Government, to the most distinguished leaders of the guerillas; and those intended for Colonel Mina will be of a quality and value fitted to mark the high sense which is entertained of his valour and patriotism."

Upon the receipt of this despatch, the author sent a copy to the Earl of Wellington, transmitting the names of the guerillas, who, it appeared to the author, were best entitled to these marks of the high estimation in which their conduct was held by the Government and people of England; and requested instructions from the Earl of Wellington, as to the terms in which the author should convey those presents to the chiefs, in the Earl of Wellington's name. His Lordship replied, in a letter, of which the accompanying is a facsimile.* (See opposite.)

This remarkable letter speaks to the people of England at the present conjuncture, as it were with a voice from the tomb, in words which show that, were the great Duke now alive, he would approve of a warfare of partizans, in combination with the operations of the regular army, as has been suggested above; for in the letter he plainly holds out such a system as worthy of imitation by a people determined, as the English people are, to maintain the independence of their country at any cost.

245. Such was the prodigious effect of the irregular warfare in Spain, that this mode of acting, when a foreign army invades a country, has been systematized in a work entitled '*Des Partisans et des Corps Irréguliers*, Paris, 1823,' by M. Le Mire de Corvey, who had himself served many years in Spain, and had witnessed the prodigious effects of guerilla warfare, combined with the disciplined valour of the British army, in repelling the intruders from the Spanish soil. This writer states on good authority that, during the seven years that the war in Spain continued, more than five

* '*Wellington Despatches*,' vol. ix., p. 201.

hundred thousand French soldiers perished in that country by the guerilla bands alone.*

246. The principle on which a guerilla warfare should be carried on, is to avoid general engagements with disciplined troops arranged in order of battle: such engagements being the particular duty of the regular army of the country, as part of the strategical combinations of the general commanding in chief the whole force of the nation. The partisan bands should hover on the flanks, and in the rear of the invading army: they should attack its detachments, overpowering all escorts which may be too weak to resist them, seizing treasure, getting possession of despatches from the enemy's commanders, and cutting off all stragglers on the line of the march. A warfare thus conducted, under the direction of skilful leaders, will not fail to keep the enemy in constant alarm: he will be attacked on every road, and will be compelled to fight in every defile, where the riflemen of the country will await him; he will not be able to send the smallest supply from one place to another without a considerable escort—thus wearying out his troops, and exposing them to numerous petty losses, without the acquisition of honour or advantage.

247. If, to protect his escorts, the enemy should construct works at the points where roads intersect one another, and should garrison them by small detachments with artillery, as the French did during the war in the Peninsula ('Des Partisans et des Corps Irréguliers, par M. de Corvey'), these detachments would be necessarily drawn from the general service, and would be useless with respect to the purpose for which the works are constructed; the partizan bands, well knowing the country, could *turn* the works by other roads, and fall suddenly upon the convoys, in places where they are not expected, and could not be effectually resisted.

248. "The partizan bands should avoid the open

* 'Des Partisans et des Corps Irréguliers.'

country, unless they happen to be superior in number to the enemy, or to consist of cavalry. Their scene of action is therefore, in general, a hilly or an enclosed country, where they may come upon him by surprise; and, without themselves incurring much loss, may inflict serious injury on the enemy, who, in a few months will, by such partial encounters, by the effects of disease, and by the other accidents which unavoidably happen in a country where the people are hostile to the invaders, suffer greater losses than might have been sustained in a general engagement. In such a war, all the inhabitants of the country are spies, watching the movements of the invaders: the day of the departure of a convoy, and the strength of its escort, are always ascertained; and, of course, measures can be taken to intercept it." (*Guerre des Partisans.*)

249. "A partizan warfare should be carried on in each district by the people whose home is in that district. In a province, every man is known to his neighbour; the consciousness that each is receiving mutual aid from another, gives a unity to the actions, which generally ensures success: and the honour due to a brave action is enjoyed the more, as it is acquired under the eyes of neighbours and friends. If the bands of one province should be led to carry on the same mode of warfare in another, the men, feeling that they are no longer fighting for their own homes and families, and that they are acting on ground which is little, if at all, known to them, find their zeal diminish: the warfare languishes, or comes to an end. The extinction of the war in La Vendée, in 1794—which, in many of its features, resembled the guerilla warfare afterwards carried on in Spain—is said to have been caused by the desertions which ensued, when it was extended into the provinces beyond the Loire, with whose inhabitants the people of La Vendée had little sympathy." (*Guerre des Partisans.*)

250. The chiefs of the guerilla bands in Spain were not distinguished officers, skilled in military tactics:

a miller, a surgeon, a curate, and a shepherd, were the men who led the peasantry of the country in a desultory warfare against the veteran troops of France. There is no doubt that men of the superior classes would be forthcoming in time of need in this country; where, moreover, there would not be wanting men endowed with military skill, as well as patriotism, to head their countrymen in a similar warfare against the troops of a foreign invader.

If, indeed, levies of irregular troops—composed of young men, very imperfectly drilled—were opposed in conflict to regular and well-trained soldiers, there can be no doubt that the former would be presently overrun and dispersed: but this is not the way in which irregular levies are to be employed. Their principal value will be as local forces, covering an extent of country which no army can protect; and their true occupation is to act as skirmishers in the movements preliminary to a general action. They should disperse over the face of the country when seriously resisted, and rapidly rally on any emergency; they should also hover on the flanks and on the communications of the enemy's army, while the latter is engaged with that of the defenders. Such are the duties of irregular troops, and the service which they may render to their country is of the highest importance. Garibaldi was a Guerrillo, and his volunteer riflemen, in the late Italian campaign (1859), were a good specimen of what such irregular troops are capable of doing. The force under that chief was not numerous, nor had the men any proficiency in discipline, yet they operated with great success upon the right flank of the Austrian army, and obtained as much glory in the campaign as any troops in either of the armies. Our British volunteers would do even more than was effected by the Italian irregulars, for they would be trained to the use of their weapons; and, if called upon to defend their country, would act under the influence of that enthusiasm which the patriotic spirit calls forth. Our regular army and our militia most efficient; and, if

to these services be added that of numerous companies of volunteers, in different parts of the empire, we might with confidence anticipate the most happy results, in the event of the whole military strength of the nation being called out for the purpose of resisting a foreign invader.

251. The acts of cruelty, committed by the guerilla-bands on the French troops who fell into their hands, were retaliatory of the severe edicts issued by the French generals, to suppress the partizan warfare, and to punish the resistance of the peasantry. Napoleon imagined, that, as in Austria, Germany and Prussia, the peasantry remained neutral—leaving it to the regular armies to decide the contest—the peasantry of Spain would, likewise, remain neutral. They did so, while they supposed the entrance of the French army into their country was a friendly measure, intended to put a stop to the disorders in Spain; but, when Napoleon took military possession of the country, defeated its armies, and seized upon the capital, after the massacre of vast numbers of its inhabitants by the troops under Murat, in May 1808, the whole people rose simultaneously against the intruders. Then began that fierce hostility between the French troops on the one side, and the Spanish people on the other. The French treated all Spaniards, whom they found in arms, as brigands; they ordered the demolition of the towns and villages which furnished men for the guerillas, and transported to France the parents and families of those who joined their bands. This induced the guerillas to retaliate; and the war became one of extermination, in which no quarter was given on either side. It is but justice to the French soldiers—who, by the command of their chiefs, murdered the guerillas in cold blood—to say that they remonstrated against such acts of cruelty, which provoked corresponding acts on the part of the Spaniards, towards the French soldiers whom they happened to surprise in the performance of the details of the military service. The document given in the note overleaf, will sufficiently explain the cause of the hostile

feelings entertained by the Spanish people towards their oppressors.*

In 1812, the Spanish government gave military rank

* Abstract from the copy of the decree issued by General Dorsenne, Commander of the French army in the north of Spain :—

“Head Quarters, Valladolid, 24th Nov. 1811.

“We, the Commander-in-Chief of the northern army in Spain, Count of the Empire, Great Officer of the Legion of Honour, &c., &c.

“Having seen the decree, dated the 6th of June, 1811, in which it is ordered that the municipalities and authorities of every chief town in each district shall make a list of all men who have absented themselves from their abodes, and do not inhabit the provinces occupied by the French troops; that their parents shall be responsible for all outrages committed by the insurgents.

“Having seen our decree of the 10th November, which assigns the 1st of January as the term of the amnesty granted to the inhabitants who have taken part in the insurrection.

“Considering that all measures adopted until now have proved insufficient to stop the progress of the insurrection; that the chiefs of the bands have sent agents to recruit in the villages, that none of these has offered resistance, and that, in several, young men have been excited by their own parents to take up arms.

“Considering that individuals in rebellion to the legitimate power ought not to exercise any civil rights whatever, or to possess any property, since the free exercise of their rights, or rather the gain of these properties, flows from the protection of the laws, which authority is disregarded by these men; that the confiscation of their properties is like an indemnity to the state.

“According to a proposition of the General Intendant we have decreed, and do decree the following. . . .

“(Signed) COUNT DORSENNE.”

The Decree consists of twenty-five Articles, and of these a few have been selected, in order to show the spirit of the whole.

The sixth Article decrees that “all persons included in the revolutionary lists shall not be able to exercise any civil rights in the district of the provinces of the northern army; shall not be witnesses to a legal judgment; they are hereby declared incapable of giving away, or receiving, by any public act among the living, or making their last will; they cannot be guardians nor trustees.”

The eighteenth decrees “that the parents of the insurgents who find themselves now arrested shall be conducted to France, if their relations have not availed themselves of the amnesty within the appointed time, and shall be placed at the disposition of the Minister of General Police of the Empire, in order that all the necessary measures to prevent their escape may be taken.”

The nineteenth decrees “that the administrators of national goods will immediately put their seal on the property of fathers, mothers, and other ancestors of the insurgents.”

It is plain that this decree was issued to counteract the great impulse which, at this time, was given to the guerilla system; it extended to the parents of partizans, authorizing the confiscation of the property of the principal and his family. It must be observed, however, that the decree had no such effect, and only more completely exasperated all who were concerned. Parents and wives gloried in the actions of their sons and husbands; and it is said that unmarried women took pride in the exploits of the men to whom they were attached.

to the guerilla-chiefs, and threatened the French with a general retaliation upon all who should fall into the hands of the Spaniards, for acts of cruelty committed upon men engaged in legitimate warfare for the independence of their country; and, at length, an end was put to these atrocities.

252. Let it not be imagined that the author recommends, for imitation in England, that lawless, disorganized system of irregular warfare, which sprung up in Spain in consequence of the fierce edicts issued by the French generals, which brought on a resort to the *lex talionis* on the part of the guerillas without the concurrence of the Government. In organizing the population of England in corps of irregular troops—in the event of invasion—as proposed by the author, every man would be constituted a soldier, subject to the commander of the regular army^a; and, however desultory his service might be, he would be taught to make his conduct conform strictly to the rules and usages of war: so that there could be no pretext, on the part of the enemy, to treat the defenders of their country as brigands; nor, on the part of these, to withhold the rights of humanity from the sick or wounded, whom the fortune of war might place in their power.

All bands or corps of volunteer riflemen should be exercised in a few simple formations, in skirmishing order; and two or three of these companies should be taught, in the event of cavalry coming upon them, to join together in rallying masses, forming something like squares. The captains or chiefs should be furnished with brief instructions for their guidance; and all should be directed to comply with any requisition made by the general or other officer commanding the division, or other portion of the regular army, with which they may be acting, respecting the quarter to which they should move or act, in order that they may conform to, and support in some degree, the general movement intended to be made. Bands of partizans and riflemen, formed, organized, and instructed in the

^a By Act, 44 Geo. III. cap. 54.

manner stated, would constitute powerful accessories to the regular army; and, with such, we may safely adopt an extensive guerilla force, like that of Spain, without any risk of its condemnable practices being followed by the people of this country.

The heroic resistance made by the Spanish people to their invaders, affords a practical proof of the efficiency of the system which the author has propounded, and which, conformably to the expressed sentiments of the Duke of Wellington, he ventures to recommend as worthy of the British people, in conducting the internal defence of their country, should it unfortunately be placed in similar circumstances.

253. It has been not unjustly said of the Spanish guerilla system, that when the allied army advanced into, and obtained possession of, the districts in which the guerillas had operated against the enemy; and the several guerilla corps—some of which had become very strong—were called in to act in line with the army; they were not found very serviceable, and were rather an incumbrance. This could scarcely be otherwise. They could not manœuvre with the army: they had been trained to avoid all regular conflicts, and to act in the desultory manner that has been described. In this way, they had done their work against the enemy; occupying many districts, before the regular army had driven the enemy out. It is no disparagement to the guerilla system to say, that, when the men were no longer required as guerillas, they were not very fit for regular warfare.

254. In proportion as the people of England may safely rely upon the protecting power of a dominant fleet to prevent an enemy from crossing the Channel, may expense be spared in bringing into operation the various means and establishments for internal defence—the elementary organization of which, however, must not be imprudently deferred. But if the external means of protection, upon which England has heretofore relied—and upon which she may always firmly rely, if duty be done—should fail, then must the regular army,

the militia, and people of England, work out for themselves the deliverance of their country; and, in order to accomplish this great end, they must prepare adequate means of internal defence, and vigorously carry on the war, with all its stern and terrible realities, on British soil.

An army of at least 200,000 infantry, with a large proportion of regular and yeomanry cavalry, and 200 or 300 field-guns, should be collected in convenient localities: these should be strongly intrenched by works disposed about them, and should be in situations where they are not liable to be *turned*, or invested on their entire circuit, (see Art. 180, p. 172). To these positions, in succession, the advanced corps of the army should retire—if overpowered, after having made the most determined resistance—in order to be supported by the main body which covers the capital. Here the most vigorous effort must be made to repel the enemy: should this not succeed, and the alternative should be either to enter the capital, or still keep the field, there should be no hesitation in deciding for the latter measure.

When Frederick II. of Prussia, by one of his victories, had opened his way to Berlin—which had been occupied by the enemy—he was advised to re-enter his capital. He declined, stating that, though it might have some good moral effect, he might be obliged to quit it again: whereas, said he, wherever the King of Prussia holds his head-quarters at the head of a victorious army in the field, that was his real military capital; and he would never abandon it. Any serious local disasters, which a firm adherence to this great military principle might permit, will be effectually retrieved by a victorious army: whereas, a dereliction or relaxation of that great principle, for any moral or political object, might lead to the greatest of all disasters—the conquest of the country.

255. It does not follow that, if London were not defended, it would be destroyed by the enemy; who would rather endeavour to secure its neutrality. To fortify London, on a circuit of at least thirty miles,

would be simply impracticable; and the number of troops which would be required to occupy the works would be so great, as to leave an insufficient force for service in the field. It would be the policy of the invader to attack the fortifications in some weak point; and, should an entrance be effected, the most fearful consequences would ensue.

It is not the interest of the invaders to destroy a capital, but, on the contrary, to preserve it—laying, however, heavy contributions as a ransom for respecting it. All the regular force of England would not suffice to fortify and defend London, together with the fortresses, the arsenals, in the country or on the coast. If the safety of the country were mainly to consist in defending fortresses, forts, and intrenched camps, we should assuredly be defeated, and perhaps conquered, in a war of posts in detail. The fortification of Paris is no case for the imitation of this country. Paris is the capital of a great continental nation, whose frontiers may be easily passed at any time, and at many points; whereas London is the capital of our sea-girt island, which an enemy can only approach after having defeated a powerful fleet, whose resistance could not fail to sink or destroy great numbers of the ships, and prevent the landing of a considerable portion of the invading army. The fortification of its capital was suggested by the condition into which France was brought by a confederation of all the powers of Europe, to put down the despotism and tyranny of her ruler, which compelled them to take arms in a common cause. And a project of fortifying Paris, in later times, could only be suggested by the possibility of a recurrence of the like circumstances. England will never bring upon herself, even if this could be done, the vengeance of outraged peoples; and she, as an insular state, may best protect her capital by rendering the shores of the island unapproachable to an enemy.

256. The following paragraph is extracted from the pamphlet entitled '*Des Partisans et des Corps Irréguliers.*' (Préface, p. xviii.) :—

"A great city, such as Berlin or Paris, cannot be defended successfully against an army, unless its inhabitants happen to be seized by some extraordinary fanaticism. The reason is plain: in all such cities, the wealthy proprietors and traders are not, or have ceased to be, military men; their minds are occupied wholly with their commerce, and they feel a not unnatural repugnance to engage in combat against the regular troops of the invader."

As Marshal Massena, in 1810,—when pursuing the army of Wellington, expecting to take the capital of Portugal, and to drive the British army to its ships,—was stopped by the formidable lines of Torres Vedras, which he did not dare to attack; so the invaders of England, seeing that the army covering London had retired into a formidable well-intrenched position, would decline to attack it. Strong in infantry, and vastly superior to the enemy in those two arms—cavalry and artillery—in both of which the invaders must necessarily be deficient, the defenders should abandon the Fabian policy, and, with their whole force assume the offensive, making a vigorous attack upon the retreating army, and letting loose swarms of irregular troops and volunteer riflemen to act on its flanks and rear. That army moving through a devastated country, surrounded by the levy *en masse* of the population, while gangs of navvies would destroy the bridges and break up the roads, would have to fight its way back to the coast through innumerable obstacles; and those who did not lay down their arms would infallibly be driven into the sea. Far different, in all probability, would be the result if the whole military force of the country were shut up in London and a few other places, however strongly these might be fortified.

257. Since much time will necessarily be required for the construction of Sir William Armstrong's breech-loading rifle guns, in sufficient numbers for general service, it becomes important that means should be found to rifle the smooth-bore guns, of which this country has so great a quantity in store; so as to

render them, at least temporarily, applicable to the purposes for which the new guns are intended. Much has been said of the conversion of the 50-pounder solid-shot naval guns into rifled cannon, for firing elongated shot; and of a similar conversion of the French field-service guns; and no reason exists why the like conversions should not be made of the British artillery. Guns so rifled would, of course, be loaded at the muzzle, as usual; but the shot being coated with lead, or otherwise prepared, would, on being fired, be forced to take the turn of the grooves, and come out effectually rifled. By such means, the vast numbers of excellent and powerful guns which we possess—the 68-pounder solid-shot gun, for naval and garrison service, and the smaller guns for the field—might thus be rendered available for immediate service. This would, perhaps, be the most important service that could be rendered to the country at the present moment.

Intelligence of what has been done in France, in thus converting the old guns into rifled artillery, has been received by the author, amongst the numerous communications which he has received from men of science and skill in that country; and he is happy to learn that the plan lately recommended by Mr. Bashley Britten, and that more recently put in practice by Sir William Armstrong, have been found to answer the purpose as effectually as can be desired. Both of the plans here alluded to, have been brought to the test of experimental trial at Shoebury Ness. The average range of Mr. Britten's 50lb. shells, at elevations of 10 degrees, was 3490 yards, and the mean lateral deviation from the line of aim was five yards. The experiments were made on the 23rd of March last. But, since that time, Sir William Armstrong has ascertained that he can rifle any number of smooth-bore guns that may be required; and, in August last, experiments were carried on with an 80-pounder and a common 32-pounder smooth-bore guns, rifled for elongated shot or shells of cast-iron. These were fired over a range of 3400 yards, at a target six feet square, six rounds from each

gun; and every shot entered the target with, it is said, *terrific and certain aim*. On the 1st of September of the present year (1859), Sir William Armstrong's 80-pounder gun was tried, also at Shoebury Ness, and gave a range of 9000 yards—above $5\frac{1}{8}$ miles.

258. The militia should be completed, at least on paper, by an immediate recurrence to the ballot. Until this be done, the military strength of England will not be placed on a sound and efficient foundation. The militia is the great source from which our army may best be strengthened; and, on many occasions in the late war, the military force required for active duty abroad received from that source great accessions of men, ready trained, and who exhibited, in many gallant actions, the vast value and importance of their services.

The slow process of raising the militia by ballot—which, by the operations of the law, requires, at least, five months from the time of issuing the royal proclamation, to its completion—should not be deferred till the country is in danger. By having the rolls of the militia always in a state of completion, nothing more will be required to bring that important auxiliary of the British army into full operation, than the Queen's proclamation for its embodiment.

The regular force should be organized in corps d'armée, consisting of 20,000 men each, with the ordinary proportion of cavalry and artillery, and a field equipment. Three, at least, of these corps should be united, to form an army to cover the capital, on the side towards which the approach may be made, and as a support of the troops in advance upon the line of roads by which the enemy may threaten to advance: every inch of this advance should be disputed by the troops.

The demands on the population of the country for naval and military service, including the militia, are beyond what voluntary enlistment can supply, considering the numbers required for the completion of the new county police force in England and Scotland (about 40,000 men), for the able-bodied men now in permanent employment on railroads, and for the

vast emigration from this country. Besides these, there must be supplied the places of men whose periods of service have expired, whether at home or in foreign stations; and those abroad have to be brought home, and relieved by others who must be sent out at enormous cost, and at great inconvenience to the public service. At this moment, when it is of the utmost importance to increase our military force in India, this regulation has produced the untoward effect of withdrawing from India 8000 or 10,000 well-trained soldiers, to be discharged at home—whilst men are at least as much required there as in this country: this is one of the evil consequences of that change in the period of service, which the author, in his place in parliament, did all in his power to prevent.

The author pointed out—by reference to the Mutiny Act, and to the practice of the Greeks and Romans—that unlimited service was not repugnant to the constitution of this country, nor derogatory to a free people; and he denied that it was in any manner the cause of desertion—which he stated was generally occasioned by some immediate excitement or dissatisfaction.

He also pointed out, that the only way to render the military service attractive, was to offer a pecuniary reward and a provision for old age.

In the Committee, March 30, 1847, the author stated that, whatever bounty were promised to a man on enlisting, it should be paid in money; and that this should not be charged with the payment of the soldier's kit: he added, that in the French service, and in that of the United States, the contents of the kit are furnished by the public; and he recommended that the practice should be adopted in this country.

He observed that, at the time he spoke, the inconvenience and expense of relieving and bringing home corps of troops, at the periods at that time regulated, were great; and he anticipated the greater difficulty which would be felt when the measure should be in full operation. Pointing out that the expense of conveying troops to India and the Colonies, and of bring-

ing them back to England, would then be enormously increased.

The author has pleasure, however, in observing that, from the latest statistical Returns relating to the present system of recruiting for the army, nearly the same number of men are enlisted every year; the whole amount in Great Britain and Ireland being nearly 50,100, or nearly 1000 men per week—not including the men enlisted for the Horse and Foot-Guards, and the Royal Marines, nor including those who volunteer from the Militia into the regular army, and the great number who, in a direct manner, join the head-quarters of regiments without passing through the district service. It is singular that the relative proportions between the numbers enlisted of the agricultural and manufacturing classes are nearly constant. From this fact, as well as from the numbers who join the several volunteer rifle corps, we are led to conclude that, under ordinary circumstances—that is, when some great emergency does not cause a sudden demand for a large increase of the army—the strength of the British military force is kept up in a regular and satisfactory manner, and the Government may safely rely, for this object, on the efficiency of the recruiting system.

The recruits, in general, do not seem to be drawn from the most ignorant class of men, since 60 per cent. of the whole number enlisted during the year ending March, 1859, are returned as being able to read and write.

In order to avoid the necessity of raising men on the spur of the moment, the measure proposed by Lieut.-Col. Eyre, of the Bengal Artillery, is deserving of consideration. This officer proposes, instead of the additional battalion which has lately been added to certain regiments of the Line, to raise a certain number of "garrison battalions" expressly for home defence, and a corresponding number of "Indian battalions" for local service in India, with liberty of exchanges being made reciprocally between these local services.

By this measure, the Colonel observes that the home battalions would become, as it were, recruiting depôts for those in India, which would thus gain a constant succession of healthy soldiers to replace those who may have been for a time exposed to the difficulties and privations of the service in the East.

On the whole, however, it would probably be the most advantageous to revert to a sound system of Ballot for the enrolment of the Militia—"the constitutional force of the kingdom," as it has been generally called; that is, we should return to a modified conscription for the defence of the country. This done, the army will, as heretofore, be recruited by well-trained men, raised from a force which no longer competes with the standing army in the mode of enlistment; and, as was proved in the late war, the benefit produced by that supply of well-trained militiamen will be the greater, in proportion as the safety of the country shall demand an increase of the regular army.

259. It is now certain that there will be no difficulty, in time of peace, in keeping to its full amount the number of seamen annually voted by Parliament for the Royal Navy, provided due attention be paid to the wants and comforts of the men at first joining, good management in respect of discipline, and more indulgence be allowed when the ship is in port; but when a sudden augmentation is required, a difficulty is felt in the attempt to meet it.

In article 212, allusion has been made to the difficulty which is likely to be felt in raising seamen by voluntary engagement, in the event of the Government being suddenly called upon, at the breaking out of a war, to *man* the Royal Navy. Since that article was written, various plans have been proposed, in order to meet such an emergency. One of these is, to select, as recruits, the best of the lads who have completed the terms of their confinement in the Reformatories of the country. The nation, certainly, has a right to the services of reformed culprits, in return for the care and expense bestowed on them for their maintenance and

education in those establishments; and such persons, subsequently trained in the discipline and duties of a ship of war, are likely to become efficient seamen and useful members of society. Another plan is, to invite landsmen and ordinary seamen to undergo a course of training in the Royal Navy, under an engagement to return to the Queen's service, when called upon, in the event of a war breaking out; they being left at liberty, in the meantime—with a small pay from the country as a retaining fee—to pursue their calling in the merchant-service. Such a measure is probably as near an approximation to the system pursued on the Continent, as the nature of British institutions will admit of.

In his speech on the Navy Reserve Bill, August 5th, 1859, Sir Francis Baring observed, that in France every man of a fit age is liable to serve in the navy, when required; the conscript is made to serve three years, and is then discharged under the obligation of returning to the duty, when called upon. Anticipating the objection that the state by this discharge loses the man's service at the very time that he is best qualified to render it, Sir F. Baring replied, that during peace this is of small importance, and that, when a war breaks out, the men thus engaged require no special training, being already able seamen. The right honourable gentleman expressed his wish that some system might be devised, which would enable the men in the royal and mercantile navies reciprocally to perform the duties of those services. Were this the case, generally, men enrolled, or called upon for the warlike navy, would already have been trained on board a Queen's ship. This is of much more importance now than formerly, on account of the employment of steam, and the improvements which have taken place in gunnery practice.

Sir M. F. F. Berkeley, in a letter to Sir F. T. Baring, dated October 6, and inserted in the 'Times' October 18th, 1859, observes that in whatever port France, when at war with England, may have a fleet, England must have a fleet in attendance; and, admitting that the opposing fleets should be engaged, he thinks it

probable that both would be nearly annihilated. Assuming, however, that our fleet sustains the greatest loss, Sir M. Berkeley is of opinion that we ought to have a reserve fleet independent of every other. This fleet should be ever at hand; and on it the protection of the country must depend. Sir M. Berkeley calls attention to the fact that, in the present system of naval armament, the smallest gun-boat carries weapons equally destructive as those of the largest ship in the service, and might cause the most serious damage to a ship-of-the-line; and that a number of small gun-boats, independent of the reserve fleet of line-of-battle ships, should be appropriated, to protect the shores of the country in the event of an unsuccessful engagement with the enemy's fleet at sea. He doubts not that gun-boats would be readily manned, by men now employed in the coasting trade, if care be taken to assure the sea-faring population at home that their services would not be required till their homes were threatened, and that they were to serve only for the defence of those homes. But it must be observed, that small gun-boats, however formidable to line-of-battle ships in inland seas and shallow waters, are utterly unfit for ocean service, or on open coasts; and that swarms of "pigmies and cockchafers" would, moreover, absorb (Art. 217, 218) a large portion of our naval resources, which it would be better to employ in the formation of a reserve squadron of ships-of-the-line*; by which, should so serious an evil as the almost total annihilation of the fleets engaged take place, we might complete the destruction of the enemy's ships, and thus bring the projected invasion of the country to an end. Sir M. Berkeley conceives that the port of Cherbourg could

* With respect to the substitution of rasees and floating batteries covered with iron plates for ships-of-the-line in the formation of fleets, the French naval officer, Lieut. Grivel, has well observed, that, however useful vessels of that description may be for special services, the nation which should be the first to abandon the system of ocean fleets of ships-of-the-line—true emblems of naval ascendancy—would soon find herself fallen from the high rank of a first-rate naval and colonial power.

be most easily watched from Spithead or Portland : but it may be said that the Channel Islands are, in reality, the advanced posts of England ; and from these that great arsenal could be most effectually observed. Alderney and Guernsey are admirably situated for resisting any attempt at aggression on our coasts from Cherbourg ; for no expedition from thence could gain the open channel without having first masked, blockaded, destroyed, or at least effectually shattered, the large steam-fleet which Great Britain would undoubtedly station at one of these islands in a time of war.

To keep on full pay ten or twenty thousand seamen permanently, in addition to the ordinary strength of the navy, is possible, but it would inconveniently increase the estimates ; and the only alternative is, to form a reserve of seamen, who may receive a modified pay for temporary service as above indicated : the terms to be settled, in an arrangement with the men themselves, so as to ensure the supply required for such service at the least expense to the country.

Admiral Sir Charles Napier observes (see his Letter to the Duke of Somerset in the 'Times,' October 17, 1859), that the evils chiefly complained of by seamen are :—first, the discomfort on board the hulks while the ships are being fitted out : when a man enters he seldom has a farthing in his pocket with which to purchase his little comforts ; for these he is obliged to go in debt to the persons who profess to supply them, and those persons commonly charge him far more than the articles are worth. This evil might, of course, be obviated by a small advance of money being made to a man, in addition to the bounty, which is commonly required for the liquidation of former debts, or for the support of his wife, if he have one. Secondly, the confinement the men are subject to on board a ship : the moment a ship goes to Spithead, or the Sound, all leave of absence is stopped, and drill begins ; that drill is carried on, too, in a manner which disgusts the men, and deters others from entering.

To provide for the contingency of sudden war, the

method lately proposed by Sir Charles Napier appears to be very feasible. The gallant Admiral recommends that there should be kept up a Channel fleet of ten line-of-battle ships fully manned with seamen, but with only half the complement of marines. At the breaking out of a war, half of each ship's crew should be turned over to another ship of equal rate, and all the twenty ships may then be filled up with marines; thus the fleet would be immediately doubled, and there would be, besides, the ships manned with the reserve seamen. The marines might be drawn from the garrisons of the sea-port towns, and their places might be supplied by the militia, who would thus have time to be completely disciplined, and ready to meet any invading army on the soil of their country.

With respect to this part of the arrangement, it may be doubted whether or not the efficiency of the fleet in time of war would not be greatly impaired by taking from the ships one-half of their crews, and supplying the places of these with fresh hands; and whether it would not be necessary that the ships, whose crews are to be changed, should go into port for the purpose. Now, there would be no time for this. Our danger is always the greatest on the breaking out of a war with France, whose fleets may be manned immediately by the facilities which her *équipages de ligne* afford; while, in this country, a precious time would be lost in the process of making a transference of hands, which at the same time detracts from the efficiency of our ships;* and these would be actually in port when they ought to be at sea.

* M. de la Gravière deprecates in strong terms ('Guerres Maritimes,' tom. ii. p. 262) the fatal error of arming and fitting ships and vessels in haste, when required for actual service; and sending their crews forth imperfectly organized, and insufficiently instructed, to fight a skilful enemy with weapons badly tempered, and therefore likely to betray the intrepid hands into which they are put—an error which we are satisfied France will never more commit. "Do little," says this distinguished officer (pp. 266, 267), "but do that little well: regard not so much the number of vessels, as the manner in which they may best be used; and be prepared, in that imposing attitude, to await the practical solution of delicate questions which press with great force upon futurity, and indicate the course which France should take in the improvement and management of her maritime affairs."

That England is most in danger at the commencement of a war with France, will be very evident on a consideration of some extracts from the proceedings of the *Enquête Parlementaire* in 1850. (See the Appendix at the end of this work.)

But it appears, from the proceedings in the late Session of Parliament, and the numerous plans which have been suggested since, as they appeared in the public journals, (see particularly Sir Francis Baring's Speech on the Navy Reserve Bill, Sir Charles Napier's Letter to the Duke of Somerset, and Sir F. Berkeley's Letter to Sir F. T. Baring on the defence of the Channel,) that no plan has yet become available for manning efficiently new-commissioned ships at the commencement of a war. It seems that the only sound and reliable plan for having a fleet always ready is, to form a standing navy manned by at least 50,000 seamen: to obtain this is, as Sir Charles Napier states it, merely a money question, and money will assuredly not be wanting to provide in this manner for the security of the country.

The French think it useless to have many more ships afloat than they can promptly *man*, and therefore they attach primary importance to establishments which no money can purchase, and which cannot be improvised—well-organized ships' crews, consisting of seamen, seamen-gunners, riflemen, and well-instructed officers. We have a vast superiority of ships afloat; but, though a first-rate maritime *people*, we have not yet provided adequate means for giving prompt vitality to new-commissioned ships by providing well-organized crews.

Our Government should ponder upon this, and view it in connexion with what is stated in the '*Enquête Parlementaire*' (see the Appendix to this work) upon the French system of *Inscription Maritime* and the formation of *Equipages de Ligne*. It should also be considered that our proposed reserve of seamen, long since voted, has not been completed, and that we are actually experiencing very great difficulty in completing

the crews of some noble ships now in commission, and much required for active service.

Until this difficulty is removed, our superiority in the *matériel* will be of no avail, in consequence of our inferiority in the *personnel*, at the beginning of a war: in short, we shall not be able to put forth the plenitude of our power, before France will have had opportunities of using, very much to our detriment, the resources with which she is abundantly provided.

The author has endeavoured to point out, as of the first and most vital importance to England, the alarming disability under which we now suffer,—and which, if not removed, we must ever experience,—that of being unable readily to man our newly-commissioned ships in case of emergency; and, on the other hand, the prodigious advantages over us, in this respect, which the French possess. We have it no longer in our power to resort to those compulsory measures by which, in former times, (as in 1717, 1790, 1791, and throughout the whole of the great French Revolution), the ships of the British Navy were manned and fitted for sea more promptly than those of any other nation, and when the menaced hostilities were arrested by the promptitude and extent of our preparations.

It appears that the French confidently anticipate that, in any future emergency of a warlike character, they, by retaining their compulsory law of enrolment, out of which their system of '*équipages de ligne*' is formed, may forthwith man for active service, a large reserve of ships and vessels; whilst we—forced to relinquish, or afraid to resort to, practices no longer deemed consistent with the spirit and feeling of the age—will have to commence a war under serious disadvantages, which can scarcely be obviated, at any cost, by our present system of voluntary engagement.

There can be no higher or more important object than that of providing an efficient remedy for evils such as these. Without this, no improvements in the Naval and Military Sciences, and nothing that Parliament can enact, will suffice to place this country in a

state of security, against such hostile designs, on the part of France, as are too plainly manifest from the tenor of the official documents which the author has indicated.

260. To be enabled, sufficiently early, to train to the use of arms, portions of our population adequate to form an extensive irregular force—proper to act, in combination with a regular army, in the manner which has been described—no time should be lost in forming the element of such a force, by calling out and training small quotas of the people, to be so instructed for short periods of service: these to be succeeded by fresh quotas, to undergo the like training; so that, when the day of need comes, all the quotas that have been trained may be called out, and formed into independent companies under a chief or captain—selected as possessing a superior degree of that zeal, intelligence, and activity, which so many will have displayed—aided by two subalterns or subordinate officers. These, together with the independent companies of volunteer riflemen, will constitute a very large irregular force; which, to be efficient, in combination with the operations of a regular army, should amount to 300,000 irregulars; the whole constituting a force of 500,000 men in arms, ready and well prepared to repel the invaders, if unhappily they should make good their landing.

261. It is not proposed to give regular pay to the volunteer rifle companies, nor to the men belonging to the quotas of the *levy en masse*—who, having been drilled, would be first called out; but these irregular corps or bands should be clad in some description of military uniform and regularly rationed, if possible. As, in their desultory operations, this may be difficult, receipts should be given by the commanders of companies, or by a commissariat officer, for all provisions purchased or impressed for the sustenance of these corps; which receipts should afterwards be taken up by the Government, and payment made to the persons from whom those supplies had been obtained.

In this manner, the population of England would

become susceptible, to a considerable extent, of promptly forming a large and well-trained active, irregular force. And no country can, in these days—having a restless, ambitious, despotic, and powerful neighbour—be considered safe, but by possessing a population so trained to arms, its arsenals well fortified, and, moreover, a powerful and well-disciplined army in the field.

These, no doubt, would be expensive measures; but we have only to choose between the national security, which they would obtain, and the awful alternative which the want or deficiency of such means would assuredly incur.

262. The rifle movement, so extensively taking place in the counties of England and Scotland, is a striking manifestation of the patriotic spirit which has been evoked in this country by the implied menace of an invasion. It forms a broad foundation on which to raise a vast irregular force composed of persons of various ranks, stations, and callings. When, at that most valuable institution, the School of Musketry at Hythe, the members of the Rifle Corps shall have been thoroughly instructed in a skilful use of their very efficient weapon; and when their companies shall be combined with a well-organized army consisting of regular troops and such of the militia as have been embodied at least one year; there can be no doubt that, with our numerous cavalry and field-artillery—our naval arsenals also being put in security—England will be enabled effectually to resist any attempt which may be made against her national independence.

But, in order that the volunteers may be efficiently taught the use of the rifle, intelligent persons should be sent to the school at Hythe, as is the case with instructors for the army, there to be perfected in the system of management pursued at the institution; and these persons should be afterwards appointed to instruct the volunteer recruits. If the funds raised by the subscriptions of the individuals composing the corps should not suffice to remunerate the instructors, it would be worthy of the Government, and, in the time of need, would

amply repay the outlay, to afford a special allowance for that important purpose.

The riflemen should be embodied in independent companies of about 100 men each, having a chief partizan volunteer and two subalterns; and the companies should be formed in two subdivisions and four squads, each squad commanded by a sergeant.

Independent troops of volunteer cavalry and mounted riflemen, each of seventy-five men, should likewise be formed.* These should be divided into sedentary and active troops. The former composed of married men, fathers of families, and the sons of widows, or of other persons dependent upon them. The active companies should consist of young men, free from incumbrance, active, enterprising, and intelligent. Great care should be taken in the selection of the chiefs of these companies. During the elementary training, in the rifle-ground, young men, possessing in the highest degree these qualifications, will soon become distinguished; and, if these be appointed, they will have plenty of followers ready to act under them. Honorary distinctions, rewards, and even military rank, should be conferred upon those who distinguish themselves in the field, whoever they may be—so as to open to them a career to military honours. Thus the situation of chief of a cavalry troop of partizan-volunteers would become very attractive; and open a fine field for the display of intelligence, enterprise, tact, and audacity.

263. The country being in danger, the rank of chiefs or captains of these irregular companies or bands of partizans would be very alluring to public-spirited, enterprising young men, of all classes. We read the narratives of irregular warfare with more interest than the details of regular campaigns; while to be a participator in exploits in which there is so much of

* Bands of guerillo cavalry kept the field, and operated with great effect in the two Castiles and other open districts throughout the Peninsular War. And their very appearance proved how harassing and even deadly they were to the enemy: for the troopers of these corps were nearly all mounted on French horses, and were clad in French uniforms of every variety, from the dress of a marshal to that of a drum-boy or trumpeter.

personal adventure, and which are so full of romantic incidents, is far more exciting than to be a simple unit in a large regular army. Hence the author feels sure that young men, the *élite* of the land, will be found when needed; and that some of them will gladly become chiefs of the irregular companies or bands of rifle volunteers.

A general regulation should be established for the management of the volunteer-partizans, and to define the manner in which they should act in co-operation with the regular army. When the *levy en masse*, or the irregular bodies of partizans, are supported by troops of the regular army, the effect is always powerful. The independent parties, thus supported, should operate with unceasing activity; they should swarm round the flanks and rear of the enemy's troops, advancing in masses or fighting in line, and make good use of their long-range rifles; there should be no conventional truce—no acts of courtesy with the advanced posts of the army that had violated the soil of their country. Fresh relays of the Companies of rifle partizans should relieve their predecessors, when necessary: whilst the regular army would prevent masses of the enemy from dispersing or driving away the swarms of riflemen that surround them.

While this sheet is in the press, a letter from General Sir W. Napier to the editor of the 'Times' has appeared in the columns of that journal, and the author has great pleasure in finding from it that his sentiments, respecting the manner of employing volunteer riflemen, accord with those of the gallant officer. Sir W. Napier well observes, that the foundation on which modern warfare rests is the instruction of the soldiers of a regular army to move in masses; but that to teach riflemen to move in that manner would be entirely in opposition to the principles of their service—that it would make them "bad regulars instead of good irregulars." The success of a battle, indeed, depends mainly on the desultory actions of light infantry, in skirmishing at open order for the purposes of covering

the marches of heavy columns, and dislodging the enemy from the posts he may have taken up in order to strengthen his position.

The line of march for an invading army is necessarily along the main roads of a country; and volunteer riflemen should, besides being instructed in the use of their weapon, be taught to avail themselves of the banks, houses, bridges, and other points at which, under cover, they may annoy the enemy in his advance: they should also be taught to select such lines for their retreat that it may be difficult for the enemy's light troops to follow them.

Believing that a dangerous crisis is approaching, Sir W. Napier suggests that the Government should take measures, as soon as possible, to communicate to the volunteer riflemen of England the instruction which will qualify them for the important service they may render to the country when that crisis shall arrive.

264. That invaluable class of operatives the navvies, should everywhere be organized into bands or companies, under the direction of the Civil Engineers and their intelligent and well-skilled assistants. These would constitute a most invaluable body of operatives, to assist in throwing up the entrenchments, laid out by officers of engineers, in breaking up roads, breaking down bridges, making inundations, and creating every possible impediment to the advance of the enemy. They should likewise be employed in constructing roads, communications, and bridges; in transforming villages, under the direction of military engineers, into military posts; also in augmenting the natural obstacles of the country, and converting every place, susceptible of being defended, into a military position.

Under so comprehensive a combination of the conditions which, when well put together, constitute military strength, men of all ranks and callings may find, in some well defined element of the combination, places in which they may devote their services to defence of the country, with distinction and to themselves.

CONCLUSION.

265. England should place reliance only in her own measures to provide effectually for the safety of the state; and, in a cause so righteous, put her trust in Almighty God, that he will bless with success the plans formed by human skill, with the appliances of human means, to enable her to repel any unprovoked aggression that may be attempted against her independence, and thus avert from this highly favoured land the greatest of national calamities.

To put England in a state of perfect security, in the manner stated in this paper, there must be, as has been said—1st, a standing navy fully adequate to the protection of her colonies and her commerce in every region of the earth, and moreover to maintain a decided superiority in the British Channel.

2ndly.—There must be an efficient army, at home, subject to reduction on a peace establishment in proportion as the naval resources of the country are developed, that development extending to the full of what may be required in a state of war.

3rdly.—The militia must be completely enrolled by resort to the Ballot, all trained by rotation of regiments during peace, and be ready for embodiment.

4thly.—The irregular forces of the country all enrolled and complete on paper, and exercised in their peculiar duties, must be ready to spring into active existence by proclamation.

5thly.—The naval arsenals, harbours, and roadsteads must be well fortified, equipped, and garrisoned. The capital covered and protected from insult, in the best manner that military experience can suggest, consistently with the means at our disposal, and with the general defence and safety of the whole country.

6thly.—The military arsenal or arsenals must be established in the most convenient point or points in the interior of the country. Coast-roads and railways must be constructed along the shores most accessible to an enemy, and the moveable batteries of ordnance must be stored in stations close to the lines by which those batteries may be rapidly moved to threatened points.

7thly.—Forts and fixed batteries must be constructed for the defence of all the great commercial cities and communities throughout the kingdom—particularly on the Mersey, the Clyde, the Tyne, and the Forth. These must be laid out by skilful engineers, and armed with the powerful ordnance of the present day; they must be manned by volunteer gunners, raised by the public spirit of those commercial communities, and their exercises for instruction must continue without intermission even in time of peace: there will thus be left available for the defence of the naval arsenals, harbours, and roadsteads, and for service of the army in the field, all the well-trained artillerymen, of whom, but for such aid, the country could not furnish a sufficient number. Thus prepared in all respects, the coast of Britain will be unapproachable, her shores inexpugnable, the interior of the country impenetrable by a foe; and England be made invincible.

APPENDIX.

(REFERRED TO ON PAGE 261.)

Admiral Dupetit-Thouars states, in reply to a leading question put to him by the Committee :—(Enquête Parlementaire).

“ Dans ma pensée, bien que l'Angleterre ait fait des fortifications, il y a toujours possibilité d'un débarquement chez elle, et pour cela nous n'aurons pas besoin de vaisseaux de guerre : nous n'aurions besoin que de 70 corvettes et d'avisos à vapeur mixtes. Avec cela nous pourrions—sans que l'Angleterre eût le moyen de s'y opposer—jeter 70,000 hommes sur la côte d'Angleterre, qui n'a jamais résisté à une invasion. Toutes les invasions en Angleterre ont été couronnées de succès : elle n'est préparée à une guerre territoriale comme nous pourrions le faire. Les Anglais n'ont pas l'esprit guerrier ; ils n'ont rien d'organisé aujourd'hui : et si nous avions la guerre avec eux, nous n'aurions qu'une chose à faire—ce serait un débarquement.”^a

Vice-Admiral Baudin, in his evidence on “ La Constitution de la Flotte,”^b states that it is not only necessary to have a naval force adequate to defence, but moreover to prepare an aggressive force, with which to undertake maritime expeditions, particularly in the Mediterranean as well as elsewhere.

With respect to manning the navy, “ l'inscription maritime ” is strongly urged by the Commission^c to be maintained to the fullest extent ; the companies of workmen in the arsenals to be increased ; and it is added that the very important institution of “ équipages de ligne ” should be rendered more efficient, in order to remedy the defect pointed out by M. Charnier (vol. i. p. 305), by forming and training special compagnies d'élite,^d consisting of tirailleurs and seamen-gunners, adequate to man, forthwith and at any time, a considerable additional naval force of ships-of-the-line, frigates and smaller vessels ;^e an advantage which is significantly adverted to in various parts of ‘ L'Enquête Parlementaire,’ as one which we do not possess, cannot speedily accomplish by voluntary engagement, and shall no longer be able to effect, as heretofore, by the press-gang ; and which will

^a Tom. ii. p. 107.^b Vol. ii. p. 187.^c ‘ L'Inscription Maritime,’ and ‘ Equipages de Ligne,’ vol. ii. pp. 188, 196.^d Vol. i. pp. 304, 318.^e Vol. i. p. 349.

therefore give to France a prodigious superiority over us at the commencement of a war.

M. de Montaignac states :^a—"Quant à la presse, dont les Anglais ont usé dans la dernière guerre, vous savez que déjà en 1793 et 1795, les révoltes très-dangereuses qui ont éclaté sur les escadres Anglaises ont été le résultat de la presse. Les officiers Anglais sont aujourd'hui convaincus qu'on ne pourrait même plus user de ce moyen."

M. de Montaignac adds :^b—"C'est ce qui me fait penser que si la France avait assez de vaisseaux pour—au premier moment d'une guerre—mettre dehors une très-forte armée, de 27 à 30 vaisseaux par exemple, nous aurions, avec une bonne organisation du personnel, un avantage considérable sur l'Angleterre, au premier moment de la guerre."

^a P. 180, tom. ii., 1851.

^b Ib.

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